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TROPICAL DISEASES BULLETIN

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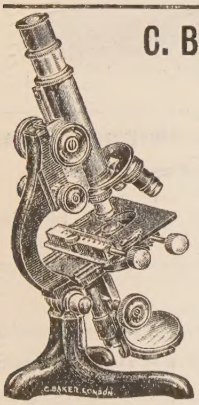

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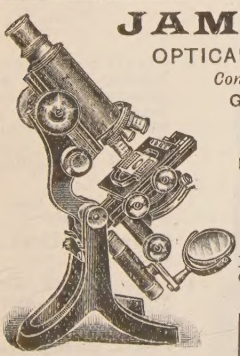

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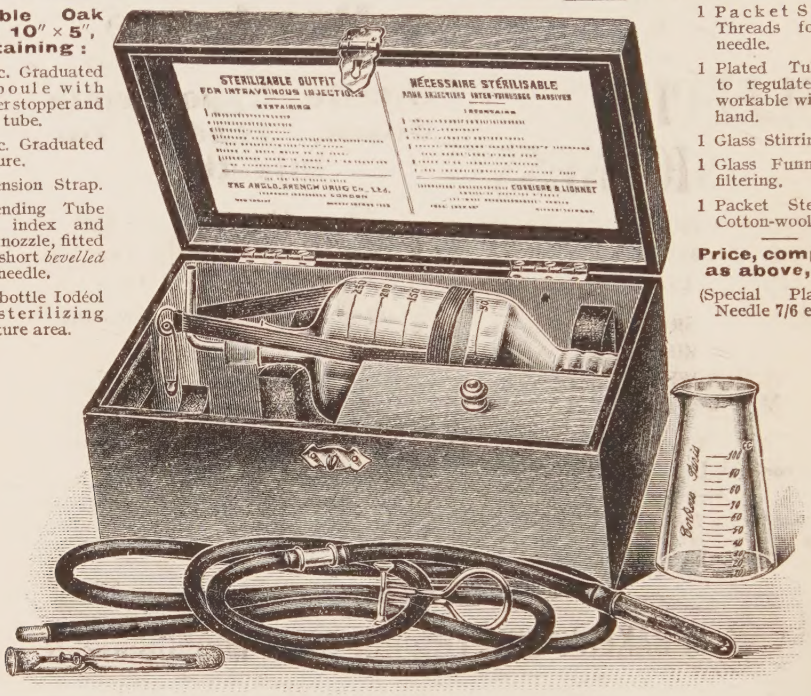

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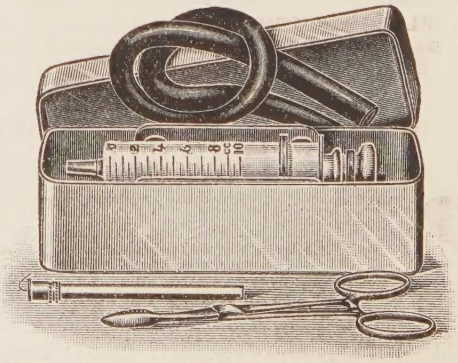

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

Vol. 8.] 1916. [No. 7.

KALA AZAR.

CORNWALL (J. W.) & LAFRENAIS (H. M.). **A Contribution to the Study of Kala-Azar. (1).**—*Indian Jl. Med. Res.* 1916. Apr. Vol. 3. No. 4. pp. 689–724. With 3 plates.

The article is divided into nine sections as follows :—

" 1. The culture of the peripheral blood as a means of diagnosis.
" 2. Experiments with cultures of *Leishmania donovani.*
" 3. The vaccine treatment of kala-azar.
" 4. The effect of different substances on *Leishmania donovani* flagellates.
" 5. Animal experiments with flagellate cultures; inoculation and feeding.
" 6. A method of feeding *Cimex rotundatus* artificially.
" 7. What happens to *Leishmania donovani* flagellates in the stomach of the bug.
" 8. Can the bug transmit the infection of kala-azar.
" 9. Summary."

1. The peripheral blood of seven cases was successfully cultured. The duration of the disease in months was 6, 1, 3, 3, 2, 2, 4. In one case the peripheral blood had shown nothing though the clinical diagnosis was beyond doubt. In another case the peripheral blood had shown nothing and the clinical diagnosis was uncertain.

" The method followed was to take a dozen or so Novy-MacNeal-Nicolle culture tubes to the bedside, to draw off a few cubic centimetres of blood from a vein in the patient's arm, and to distribute the blood among the culture tubes. In the two Coonoor cases the tubes were brought straight back to the laboratory and stored in the dark room at the air temperature 20°–23° C.

" In the Madras cases the tubes were packed in a box containing some ice to keep the temperature in the neighbourhood of 22° C, and brought up to Coonoor.

" A few tubes remained sterile, but in the majority flagellates grew freely. In one case six out of eight tubes gave good cultures and in another all the eight tubes inoculated gave cultures."

2. The following experiments were made :—

" (*a*) The condensation fluid of N.N.N. tubes containing cultures of the flagellates was centrifugalized and the deposit, after washing in 0·85 per cent. NaCl to free it from any trace of rabbit serum, was dried without heat and ground in an agate mortar. It was then emulsified in a small quantity of 0·85 per cent. NaCl and mixed in varying proportions with washed human erythrocytes. No lysis or agglutination was observed after three hours' incubation at 37° C.

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"(*b*) Further quantities of the flagellate extract were mixed with whole human blood to test its influence on the coagulation time, and it was found to be quite inert in this respect.

"(*c*) Very careful experiments were made with a strong extract of flagellates and the serum of a kala-azar patient to see if deviation of complement could be demonstrated, but without success; so it must be concluded that specific antibodies are not present in the blood of a well marked case of kala-azar.

"(*d*) A watery extract of dried flagellates had no proteolytic action on coagulated white of egg at either 38° C. or 55° C.

"(*e*) Flagellate extract injected into rabbits either subcutaneously or intravenously has no irritant or toxic action whatever."

It is concluded from these experiments that (assuming the flagellate form to have the same properties as the Leishman-Donovan body) the parasite influences body metabolism and causes death purely by cell destruction, as is the case in rabies.

3. Of two cases in which vaccine treatment was tried one died, and the other, after seeming to improve, was lost sight of.

4. "Fresh vertebrate serum is generally fatal to *L. donovani* flagellates within a few hours but they may survive 24 hours or more. Heated serum is less inimical. The flagellates can survive and multiply for over 48 hours in the latex of certain Euphorbias. Media prepared with rabbit blood are the only ones that can be relied on, either to procure cultures from the peripheral blood of a kala-azar patient, or to carry on subcultures of the flagellates."

5. *L. donovani* flagellates do not penetrate the epithelial cells of the rabbit's stomach when mixed with scrapings of the mucous membrane.

Nine local garden Lacertidae and eight house geckos from Madras were inoculated intraperitoneally or subcutaneously or fed with flagellate cultures: negative result.

One monkey and one white rat, inoculated subcutaneously: negative result. Two monkeys and four white rats inoculated in left testicle: negative result. One white rat was infected by an intraperitoneal injection of flagellates. One white rat was fed on bread soaked in flagellate culture 23 days old, on 2nd August flagellates developed in N.N.N. tubes inoculated from its heart blood on 25th September. Bugs were fed on this rat on 5th October but none became infected. The rat was killed the same day. Smears from its organs and further cultures proved to be negative.

6. It was found that bugs will feed on citrated blood through a membrane of rabbit skin [cf. this *Bulletin*, Vol. 1, p. 124.]. The apparatus consists of a glass cylinder about 6 cm. in length, cut from the upper end of a test tube about 1·5 cm. in diameter. A piece of skin from the abdomen of a rabbit is tied over the flanged end with thread. This cylinder contains the citrated blood. The bug to be fed is placed in a test tube of rather larger size, containing a roll of filter paper cut level at the top and with a V-shaped notch through which its movements can be watched. The level edge of the filter paper is drawn up to the mouth of this tube and the smaller tube containing the feed is placed in contact with it and fixed in position with strips of plasticine.

Strict aseptic precautions must be observed throughout, or bacteria may be ingested and the experiment spoilt. The bug's stomach apparently never normally contains bacteria.

7. *L. donovani* flagellates can survive at least 29 days in the stomach of the bug.

The following remarks are made in connection with a hitherto undescribed phase of the parasite in the bug's stomach. For full details and illustrations, the original paper must be consulted :—

"A most peculiar and striking object appeared in a certain number of the fresh preparations of the contents of the stomachs of infected bugs. It was observed after feeds on both citrated rabbit blood and citrated human blood mixed with flagellate cultures, as early as the third day after the feed and as late as the 23rd day after. It was never seen in bugs uninfected with flagellates, and it never appears in N.N.N. culture tubes. . . .

"The usual form of this object, which we may allude to as a 'thick-tailed flagellate' or, more shortly, as a 'thick-tail' until its nature has been determined, is easily visible with the power employed for fresh preparations (Zeiss 4 mm. apochromatic with No. 6 compensating ocular). It is a roundish body, about 5 or 6 microns in diameter, furnished with a long flagellum, four or five times as thick as the flagellum of an ordinary flagellate, which undulates rapidly. The body is colourless and non-granular and has a double outline. Whether the thick-tail exists as such in the bug's stomach or is only formed after the preparation has been made, has not yet been decided; but, as fully developed thick-tails have been seen within a few seconds of focussing the slide, and as the time occupied in teasing the stomach and making ready the preparation is not in excess of three minutes, it seems probable that its formation is not due to removal of the stomach contents from the bug but that it pre-existed in the bug."

8. Series of bugs fed on citrated rabbit blood plus flagellate culture, and on citrated human blood plus flagellate culture, were allowed to feed after varying intervals on citrated rabbit and on citrated human blood through a rabbit skin membrane, tubes of N.N.N. medium being then inoculated from the second feeds. No growth took place in the N.N.N. tubes though many of the bugs were proved to be still infected. The conclusion arrived at is that the bug cannot transmit flagellates in the act of feeding, even though they are present in its stomach.

E. J. Wyler.

ARAVANDINOS (Anast.). **Modification dans la technique de la ponction de la rate.**—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 444–448.

The author claims that by his modifications in technique spleen puncture is rendered practically safe. They are as follows :—

1. A piece of rubber tubing, which must not be too thin or collapsible, is interposed between the needle and the syringe. By this device the needle is able to follow the respiratory movement of the spleen while the piston is rising. As ordinarily used the rigid attachment of the needle to the syringe restrains its movement and tends to lacerate the spleen tissue, an effect which is accentuated by movements communicated to the needle by the hands of the operator as he withdraws the piston.

A steel needle of not too fine a bore should be used.

2. The withdrawal of the piston is rendered automatic by fitting a spring round the piston-rod (which for this purpose is lengthened) outside the barrel between the top of the latter and the handle. A Record syringe of 2 cm. capacity is used. The spring is held compressed by a lever extending along the side of the barrel to its lower

end and is released at the moment the needle has been inserted to the required depth. As soon as the spring is released the needle is withdrawn. The piston should be lubricated with sterilized vaseline to ensure easy working.

By thus causing the piston to rise automatically the speed of the operation is appreciably increased.

The author emphasizes the fact that speed is essential for the avoidance of danger and advises that the operator be content with the amount of splenic juice drawn into the needle, and do not wait for it to enter the barrel of the syringe.

E. J. W.

Ward (Gordon R.). **Kala-Azar in Soldiers returning from Malta.**—*Lancet.* 1916. July 1. pp. 16–17.

The object of this paper is to draw the attention of general practitioners inexperienced in tropical medicine, many of whom are now treating returned troops, to the possibility of kala azar in the presence of splenomegaly in soldiers who have been abroad. Two cases are mentioned in both of which the parasite was found on spleen puncture. Neither patient had ever been further east than Malta.

E. J. W.

Rai U. N. Brahmachari Bahadur. **Third Report on the Treatment of Kala-Azar with Special Reference to the Use of Antimony and Formaldehyde.**—*Indian Med. Gaz.* 1916. May. Vol. 51. No. 5. pp. 173–178. With 4 charts.

For the previous two papers see this *Bulletin*, Vol. 8, p. 5. The paper now under review is divided into four parts as follows :—

1. Cases treated with metallic antimony.
   (*a*) colloidal metallic antimony.
   (*b*) in a state of fine subdivision as an impalpable powder.
2. Cases treated with compounds of antimony.
3. Cases treated with intravenous injections of antiseptics: formaldehyde and eusol.
4. Alkaloidal therapy.

1 (*a*). Two cases are described in both of which the results were encouraging. Dosage was as follows :—

In the first case four intramuscular injections of 0·001 gm. were given on successive days and nineteen intravenous injections of 0·002 gm. on the next successive days. A twentieth injection was given eight days after the nineteenth injection.

In the second case fifteen injections of 0·002 gm. and five injections of 0·003 gm. were given intravenously.

(*b*) Four new cases are described. As in the seven cases recorded in the previous reports, the treatment was followed by marked improvement. The number of injections given were, in one case 7, in one case 3, and in the remaining two 4.

2. A number of further cases are described which were benefited by treatment with intravenous injections of tartar emetic and antimonyl sodium tartrate. Comparing the effects of these salts with metallic antimony it is remarked that in the case of the latter, fewer injections (3 or 4) are required to produce a beneficial effect, whilst it is quicker

in its action and toxic symptoms are less marked. Contrasting colloidal metallic with metallic antimony it is pointed out that the former is given in very small doses and that as it may be injected in 2 cc. suspension it is very convenient to use. It is followed by no unpleasant symptoms.

3. *Formaldehyde.* Two further cases are described (making three in all), in which intravenous injections of this drug were followed by great improvement. In the first case dosage was as follows :—

18 cc. of 1/4000 solution on the 1st day.
36 „ „ 1/4000 „ „ „ 2nd „
35 „ „ 1/3000 „ „ „ 3rd „
36 „ „ 1/3000 „ „ „ 5th „
34 „ „ 1/2000 „ „ „ 10th „

Formaldehyde is unstable and hence different samples vary in strength. The author is experimenting with formaldehyde sodium disulphite, which is more stable and is obtainable in crystalline form.

Eusol, prepared after Lorrain Smith's formula. A single case was treated with the result that as far as the blood picture was concerned there was slight improvement. The size of the spleen however was unchanged. The doses varied from 55 cc. to 200 cc. given intravenously on successive days.

4. Intravenous injections of quinine bihydrochloride, narcotine, berberene sulphate and bebeerene sulphate were tried. The results were not encouraging.

E. J. W.

da Matta (Alfr.). **Sur les leishmanioses tégumentaires. Classification générale des leishmanioses.**—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 494–503. With 2 plates.

This paper is concerned with dermal leishmaniasis in South America, especially as it is found in Brazil. It deals for the most part with those cutaneous and muco-cutaneous lesions ascribed to the action of *L. brasiliensis.* The conditions are minutely set out and the descriptions cannot be here reproduced in detail.

Two non-ulcerating cutaneous forms are first described. The one—a papillomatous type— occurs as small hemispherical nodosities, which may attain the size of a pea, the affected area being of a deep red colour and excreting an ichorous fluid which in time forms a more or less thick crust. In the second variety large irregular nodosities are formed which may assume a cauliflower-like appearance. In both varieties there is a great tendency to haemorrhage, especially where particles of tissue have been removed for the purpose of making smears. The condition may persist for 15 years or more without ulceration. Any part of the body may be attacked but it is most frequently found on the legs.

The author then proceeds to describe the ulcerating varieties of the disease, dealing first with those affecting the skin only and then the varieties affecting also the mucous membranes.

The skin condition commences with itching, at the site of which a papular erythema develops. Two to five days later pustules form which break down. The itching now ceases and the stage of ulceration begins. Spontaneous cure is uncommon.

Leishmaniasis of the mucous cavities is *always* mucocutaneous. It begins in the same way as the preceding variety, is exceedingly intractable and is regarded by the author as " malignant."

Two observations are given as being clinically important for differential diagnosis: (1) leishmaniasis does not attack the nasal bones and may thus in advanced conditions be distinguished from syphilis; (2) ulcers on the lips and at the edge of the nostrils which just touch the mucosa without however invading it are due to *Treponema pertenue.*

E. J. W.

d'Utra e Silva (Oscar). **Sobre a Leishmaniose tegumentar e seu tratamento.** [On Cutaneous Leishmaniasis and its Treatment.] —*Mem. Inst. Oswaldo Cruz.* 1915. Vol. 7. No. 2. pp. 213–248. With 11 plates and 2 text-figs.

A very complete account of cutaneous leishmaniasis, as it occurs in Brazil, and of its treatment with tartar emetic according to the method of Vianna. So much has appeared in print on this subject already, of recent years, that the author has not much that is additional to communicate, in the way of information. His practical experience, however, has been large, and his results in the way of treatment appear to be very successful. The dose of tartar emetic recommended for the treatment of cutaneous leishmaniasis ranges between 5 centigrammes for a minimum and 1 decigramme for a maximum, for a single dose, dissolved in 100 times its weight of distilled water and filtered through a Chamberland filter [see illustration]. In 44 per cent. of the author's cases, from 10 to 20 injections sufficed for a cure, in 33 per cent. 20 to 30 were required, and in 5·5 per cent. over 30, while in 11 per cent. less than 10 sufficed. Two or three injections should be given per week to begin with and the injections may be increased to one per day as the case proceeds, if found necessary, but the author strongly insists on the difference between a dose that can be tolerated by the patient, and that which will suffice for cure. The latter should always be the one aimed at. Salivation, nausea and diarrhoea, with headache and sore throat, are the penalty of excessive doses.

J. B. Nias.

Escomel (Edmundo). **Leishmaniasis cutanea curada por el tartaro emetico.** [A Case of Cutaneous Leishmaniasis cured with Tartar Emetic.]—*Cronica Med.* Lima. 1916. July. Vol. 33. No. 637. pp. 207–208.

A report of a case of leishmaniasis of the ear, chin and leg in a Japanese, which was cured by Vianna's method. The ulcers were powdered with dry tartar emetic, after a previous application of Bonnain's anaesthetic liquid (equal parts of menthol, cocain and crystallized carbolic acid), which was allowed to act for two minutes. The surfaces were then covered with borated cotton-wool for 24 hours to allow of the formation of a slough, and afterwards dressed with Championniere's ointment (zinc, bismuth, balsam of Peru, xeroform and vaseline), until healthy granulations were obtained. The local

treatment was thus rendered painless. Simultaneously an endovenous injection of 5 cc. of a 1 per cent. solution of tartar emetic was given, followed by a second one of 10 cc. in a week's time. Complete cicatrization was obtained in 20 days from the commencement of treatment.

J. B. N.

Dudding (J. S.). **A New Treatment for "Oriental Sore."**—*Jl. Roy. Nav. Med. Serv.* 1916. July. Vol. 2. No. 3. p. 348.

A record of a case of ulcer of the leg which had resisted ordinary methods of treatment for 16 months and which was healed in eleven days by the application of a solution of malachite green perchloride of mercury. It would, however, appear from the context that the diagnosis of "Oriental Sore" was made on clinical grounds and that leishmania were not detected.

E. J. W.

Finzi (Guido). **Leishmaniose et tuberculose chez le chien.**— *Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 429-432.

The description of a case of leishmaniasis combined with generalized tuberculosis in a dog, naturally infected in Africa which died in Turin. The author remarks that parasites "easily identified as *L. infantum*" were found in smears made from the spleen. Leishmania were also found in the peripheral blood.

E. J. W.

YELLOW FEVER.

West Africa, Yellow Fever Commission. **Reports on Questions connected with the Investigation of Non-Malarial Fevers in West Africa.** Vol. III. viii + 291 pp. With maps & illustrations. 1916. London: J. & A. Churchill. [Price 10*s.* 6*d.* net.]

This volume is divided into seven parts as follows :—

1. Report of the Entomological Investigation undertaken for the Commission for the year, August, 1914, to July, 1915. By A.W. Bacot, F.E.S. (*Entomologist to the Lister Institute of Preventive Medicine*).

2. Correspondence relating to the possibility of the introduction of Yellow Fever by land into Sierra Leone, *illustrated by one map.*

3. Correspondence relating to the possibility of the introduction of Yellow Fever by land into the Gold Coast, *illustrated by two maps.*

4. Correspondence relating to the introduction of infection into the West African Colonies by sea.

5. Report on the examination of human blood in England for the presence or absence of "Seidelin Bodies" (*Paraplasma flavigenum*), the so-called parasite of Yellow Fever. By John Westray Cropper, M.B., Ch. B., M.Sc. (Liverpool). (*The John Howard McFadden Researches, The Lister Institute of Preventive Medicine*).

6. Notes on the rearing of *Stegomyia fasciata* in London. By Malcolm Evan MacGregor (*Wellcome Bureau of Scientific Research*).

7. Some observations on Fevers investigated in Quittah, March to June 1914. By G. E. H. Le Fanu, M.B., C.M. (Aberdeen), D.T.M. (Liverpool). (*West African Medical Staff*).

Parts 1 and 7 are dealt with under separate headings in this issue of the *Bulletin*, and Part 6 in Vol. 7, p. 190.

In Parts 2 and 3 it is seen that there is free intercommunication by numerous trade routes between the Colonies concerned and adjacent countries.

In Part 4 are included the results of examinations of vessels of all kinds with respect to the possibility of conveyance of mosquitoes and larvae. It would appear from a study of this section that the introduction of infected insects by sea into the West African Colonies is improbable.

E. J. Wyler.

Bacot (A. W.). **Report of the Entomological Investigation undertaken for the Commission for the Year, August, 1914, to July, 1915.**— *Yellow Fever Commission* (*W. Africa*). Reports on Questions connected with the Investigation of Non-Malarial Fevers in West Africa. 1916. Vol. 3. pp. 1–191.

The work embodied in this Report was carried out for the most part at Freetown, Sierra Leone.

As a result of the outbreak of war the original scheme of work instituted by the Yellow Fever Commission had to be modified and the investigations of the entomological section were largely confined to the confirmation and elaboration of the existing knowledge concerning the bionomics of *Stegomyia fasciata*.

The following is a summary of the chief conclusions arrived at :—

" Mosquitoes at Freetown.
II.—Bionomics of *Stegomyia fasciata.*
(A.) Eggs.

" (*a*) *Shape and structure.*—The dark spindle-shaped eggs of *S. fasciata* vary considerably in shape and size, affording specimens which approximate closely in general appearance to those of the allied *S. sugens, S. luteocephala* and *S. simpsoni,* all of which differ appreciably among themselves.

" The bosses with which the eggs are studded are not mere structural excrescences of the shell, but are pockets containing small masses of a substance which, unlike chitin, is readily stained by haematoxylin ; these bosses are possibly connected with the ability which the eggs seem to possess of replacing moisture lost through desiccation.

" (*b*) *Laying.*—If actually laid on the water surface they are usually deposited so close to the margin as to become stranded by capillary action on the sides of the pools, or on partially submerged objects, such as dead leaves, lying in it. In many instances eggs were laid on wet surfaces quite beyond the limit of capillary action.

" (*c*) *Hatching and the conditions which control it. Experiments I. to XVIII.*—Incubation seems to invariably follow laying within 30 to 40 hours, at the Freetown temperature, but the hatching of any given batch may be distributed over a lengthy period. Apparently the eggs are endowed with a complex constitution, which allows of the whole of a batch hatching together, so soon as they are placed in water, or of a scattered emergence of the larvae consistent with the view that some internal machinery which produces zonal or sectional hatching has been called into action. Experiment No. XVIII. suggests that the latency or activity of this machinery is determined by the conditions of humidity or drought which prevail *after* incubation. When a batch of dried eggs is placed in water a certain proportion generally hatch within a few minutes or hours, but others, apparently belonging to the same hatching zone, may resist the first or second immersion, yielding to some subsequent one. Similar powers of resistence will probably be shown by a proportion of the eggs in each hatching zone of a given batch.

" After a series of experiments, Nos. IV. to XIII, in which various possible factors were tested, evidence was obtained that cooling to the extent of some 5° or 10° F. acted as a stimulus to induce the hatching of eggs that would otherwise have deferred doing so (Experiments Nos. XIV. to XVI.). A response to cooling accords well with the needs of the species, as a distributed emergence of larvae so arranged allows of full advantage being taken of the increased facilities afforded for breeding in small and rapidly drying pools with the advent of rain.

" *Experiment No. XIX.*—Agitation of the water, mentioned by Mitchell* as a factor in the hatching of eggs, failed to give any decisive result.

" Bacterial action would appear also to be an important factor in hatching and in some instances to be essential.

" (*d*) *Period of viability. Experiment No. XX.*—The period during which the eggs retain their viability would seem to be to some extent conditioned by temperature, humidity and ventilation, but, owing to the destruction of stored eggs by book-lice (*Psocidae*) (Experiment No. XXII.), no adequate statistical evidence on this point was obtained. The longest period of viability was 262 days ; in another test large numbers hatched after 200 days' dry storage. When kept continually immersed some eggs did not hatch for periods of from two to five months. (Experiments Nos. V., VI. and VII. show examples.)

" (*e*) *Temperatures which the eggs are able to survive. Experiment No. XXI.*—Eggs brought back from Freetown and those laid in England hatched after exposure to 28° F. and 30° F. for 24 hours, but none hatched after an exposure of 25 days. 24 to 28 hours at 96° F. did not greatly, if at all, affect the percentage hatching at Freetown. In the experiment carried out at the Lister Institute there was a marked difference in the hatching percentage of Freetown eggs and those laid in London

* " ' Mosquito Life,' page 26."

after exposure to 96° F. A few hatched after 24 hours' exposure to 102° F., but all the eggs of a batch placed at 108° F. for 24 hours failed.

"(*f*) *Enemies of eggs. Experiment No. XXII.*—The only active enemy discovered was a species of book-lice (*Psodicae*) which wrought immense havoc among the stocks of stored eggs. Ants, considering the untiring activity of their search for the smallest particle of food, seemed strangely indifferent to the eggs.

(*B*) Larvae and Pupae.

"The larval period is conditioned by temperature and food, breeding tests dealing with the latter factor only were practicable at Freetown, although some trials concerning the survival limits in regard to temperature were carried out.

"(*a*) *Experiments Nos. XXIII. to XXV.*—A very wide range of organic matter will serve as food for the larvae of *S. fasciata*, and the water may be so heavily charged as to become foul and thick, without harming the larvae, so long as it remains free of scum, floating oil or fat.

"(*b*) *Period of larval life.*—Under the most favourable circumstances the larval life is passed within four days; on the other hand, with a scarcity of food, it is prolonged for upwards of 70 days. In tap water of average purity the larvae are unable to pass the first moult apart from added nutriment, but they continue to mark time until the death of their fellows enables a few to complete their development. Probably, in an uncovered breeding pool the fall of organic dust would be sufficient to afford food for a fair number of larvae.

"(*c*) *Small adults reared from starved larvae.*—Shortage of food results in the production of small sized adults—a somewhat important point on the practical side. Well-covered cleanly cisterns therefore require cover of specially small mesh wire gauze (not less than 18 × 18), there being always a danger that eggs will be washed in from gutters during rain.

"(*d*) *Interaction between larval growth and the development of bacteria. Experiments Nos. XXVII. and XXVIII.*—Experiments show an apparent association between the speed of larval growth and the development of bacteria. The scarcity of bacteria in the gut of larvae taken from water swarming with these organisms is probably evidence of the speed with which bacteria are assimilated, as it seems improbable that, by the use of the mouth brushes, or any other means, the larvae could avoid swallowing them. The marked clearing action of mosquito larvae in foul water affords a parallel instance of interaction between them and the bacteria, although this might be a secondary effect due to the absorption of organic matter by the larvae, and not the ingestion of the bacteria. Experiment No. XXVIII. affords evidence of this interaction, and shows that, when two similarly stocked beakers were prepared, in one of which bacterial action was given four days' start of the larvae, the bacteria absorbed nutriment, which, even in the event of the larvae devouring them, could not be regained.

"(*e*) *Temperature which the larvae and pupae are able to survive. Experiment No. XXX.*—Larval growth and pupal development proceeded normally in a large tin exposed to full sunlight—the temperature of the water rising to 103° on one occasion. Trials with larvae and pupae taken from this tin showed that the upper limit of temperature they could survive lay between 112° F. and 115° F. As regards cold, pupae reared at 80° F. remained active at 50° F., but about half the larvae submitted to the test became stiff and immobile at this temperature, quite irrespective of size. With a further reduction to 40° F. all the larvae became immobile at the bottom, while the pupae, with two exceptions, also lost all power of movement, but remained at the top. Both larvae and pupae recovered when the temperature was allowed to rise, but there was a mortality of 6 out of 40 larvae and 2 out of 24 pupae submitted to the test.

"(*f*) *Survival of larvae and pupae when submerged. Experiment No. XXIX.*—183 larvae and 40 pupae were submerged in a wire gauze tube of 18 × 18 mesh for 20 hours; 8 per cent of the pupae and 27 per cent. of the larvae survived.

"(*g*) *Survival of larvae on wet filter paper.*—Two larvae in their fourth skins were stranded on a piece of filter paper which was kept continually wet; one lived three and the other 10 days.

"(*h*) *Enemies of the larvae. Experiment No. XXXII.*—As pointed out by MacGregor,* the larger larvae of *S. fasciata* apparently consume the smaller ones; mortality from this source seems to be limited to larvae undergoing the first moult being ingested by those in their fourth instar. The habit of breeding in small collections of water, while saving the species from the attacks of many enemies, enhances the danger of fratricide, but the species is safeguarded from this risk to a considerable extent by the intermittent hatching of the eggs. Tadpoles, as stated by several authorities, certainly do not attack well-grown mosquito larvae, though they probably have a checking influence, owing to competition for food. It seems possible, however, that the small larvae undergoing their first moult, might be engulfed by tadpoles with other food. A small water-bug, found in rock pools, attacks the larvae of *S. sugens*, and probably other species as well, but it was never seen in sufficient numbers to be a serious check. A species of *Ostracoda*, belonging to the genus *Cyprii*, seems to be inimical to mosquito larvae, apparently as a competitor for food.

(*C*) Adults.

"(*a*) *Pairing and feeding.*—In captivity there seems to be no regular precedence either of pairing or feeding; both functions are practised at any hour of the day or night—late afternoon being perhaps most favoured. The act of pairing commences during flight and occupies only a few moments, but is possibly repeated at frequent intervals. A single male is able to impregnate 10 females more or less effectually, and to fertilize 750 eggs (Experiments Nos. XLVI. and XLVII).

"(*b*) *Development of eggs. On a single meal of blood and also on blood other than human.*—In feeding satiety is evidently aimed at, and an interrupted meal is completed as speedily as possible; a perspiring skin attracts more readily than a dry one. A single full meal of blood is sufficient for egg production in many cases, possibly for all, though the eggs are sometimes retained for many days. The blood of rats, dogs, goats and bandicoots seems just as effective for the development of the ovaries as human blood, but blood taken up from a living host seems to be a practical, though not a theoretical, necessity. *Fed on blood mixed with syrup. Experiments Nos. XLIV. and XLV.*—A single fertile egg was laid when the only food given was blood from a sheep mixed with syrup.

"(*c*) *Feeding in relation to egg laying.*—Females with ripe ovaries usually refuse to feed until they have deposited the bulk of their eggs, when they feed greedily. Females in their period of greatest vigour tend to develop and lay their eggs in masses at about three-day intervals, feeding on the first and second days after depositing their eggs, and fasting while the ovaries are full; Experiment No. IX. and the Appendix to Experiment No. XLVI. are typical instances. The female used in the latter experiment laid 837 eggs in twelve batches, exclusive of odd eggs, while the former, in 22 days, laid 712 eggs in fifteen batches.

"(*d*) *Retention of eggs.*—Fertilized females that have only received a single meal of blood may retain their eggs for a considerable period before laying them; Experiment Nos. XLI. and XLII. show examples.

"(*e*) *Choice of situation for depositing eggs.*—Tests showed that the widely-held opinion that the kitchen and boys' quarters are the most likely situations to look for *S. fasciata* was in the main correct, but it seems questionable if the preference is not as much due to the likelihood of there being foul water present, as to the chance of feeding on the boys. No eggs were ever deposited in a jar of clean water kept in the boys' bedroom.

"In the mosquito house a wooden tub or tin pans were favoured as against a galvanized iron pail; Experiment No. XXXIII.

"(*g*) *Eggs not laid apart from wet surfaces. Experiment No. XLIII.*—Fertilized females regularly fed on human blood would not oviposit when no wet surface or water was available.

"(*h*) *Length of adult life. Experiment Nos. XXXV to XL.*—The longest lived specimen was the female used in Experiment No. IX, which was killed by ants after 95 days. The longest lived male life was 50 days, in Experiment No. XXXVII. Average lives of 29 days for males and 44

* "*Journal of Tropical Medicine and Hygiene.* No. 17, Vol. 18. 1st Sept., 1915, page 195."

days for females are shown in Experiment No. XXXVIII, the specimens being fed on syrup and kept in a still and, for Freetown, not very moist atmosphere. Specimens kept in wire gauze tubes give very much lower averages, and no evidence was obtained that *S. fasciata* can habitually, or is likely, save under very exceptional circumstances, to tide over the dry season in the adult stage.

"(*i*) *Enemies in the adult stage. Experiment No. XLVIII.*—Owing to its retiring habits, *S. fasciata* probably suffers more from wingless than winged foes once it has gained entrance to a dwelling. Ants proved themselves to be deadly foes to caged mosquitoes; two species of spiders, one a small web spinner, the other larger, spinning no regular web, practically lived on *S. fasciata* in the mosquito house, and a small flattened scorpion was also discovered, which ate large numbers when confined in the same box with it. Young mantidae were also found to capture and devour them. Ants, spiders and, perhaps, the scorpion are probably serious enemies even to active, unconfined specimens; the continual waving of the raised hind legs of the resting insects is, I suspect, a measure of preparedness to avoid attack by wingless foes.

"A slender wall-haunting lizard quickly cleared a large cage of *S. fasciata* and probably acts as a salutary check to their increase.

III.—Parasites.

"The only parasites encountered were a gregarine *Lankesteria culicis* Wenyon and a species of yeast.

IV.—*Sterility of the Pupal Gut.*

"Experiments carried out in collaboration with Dr. G. G. Butler, although not conclusive, point to the probability of the sterility of the pupal gut, in so far as infection by bacteria is concerned.

VI.—Eggs Laid on Fallen Leaves in Water-holes.

"Eggs are laid on fallen leaves lying in water-holes. The following species were bred from leaves taken from an empty water-hole in January and immersed in March:—

"233 specimens of *S. fasciata*; 24 of *S. simpsoni*; 81 of *S. luteocephala*, and 14 *Ochlerotatus apicoannulatus.*

VIII.—Experiments Dealing with the Destruction of S. fasciata. Experiments Nos. XLIX, LI, LII, LIII.

"Naphthalene at 1 in 4,000, under the conditions of Experiment No. LI. is an effective larvicide. [Young larvae were placed in 4,000 cc. of tap water, and 1 gramme of naphthalene was sprinkled on the surface. The water was contained in a tin six inches in depth with an approximate surface area of 80 square inches. With the tin uncovered, most of the larvae were quickly killed, but a few survived. With a covered tin all the larvae were killed, and also pupae and adults emerging from them.] At 1 in 8,000 it is more effective than petroleum, but allows of a few survivors. Soft soap, at less strength than 1 in 1,000, is not an effective larvicide.

"Emulsions of soft soap and petroleum are far more effective larvicides than either of them used separately, killing all larvae and pupae at 1 in 16,000 (water temperature about 80°, experimental pans covered with cheese cloth). With naphthalene added to the emulsion it was equally effective at 1 in 20,000.

"As against submerged eggs petroleum and soft soap emulsion at 1 in 8,000 is not effective in killing the larvae within the eggs. It has the result, however, of inducing a high percentage of the less resistant eggs to hatch at once, when the young larvae are killed.

IX.—Effect of Salt Water on Larvae, Pupae and Eggs of S. fasciata. Experiments Nos. LIV to LVII.

"Salt water (from Freetown Harbour) speedily kills the larvae of *S. fasciata* but does not destroy the pupae.

"As against the eggs, though it does not destroy them, it causes a high percentage of the less resistent ones to hatch at once and a considerable percentage of the specially resistant. The young larvae, after hatching, are speedily killed by it. The use of salt water for flushing culverts and gutters and watering roads might, if practicable, prove very beneficial. The effect of salt water as a stimulus to hatching appears to be unconnected

with its specific gravity ; a solution of sugar of the same specific gravity gave different results and both differed from the tap water control. Both solutions, however, were apparently responsible for a mortality of 7 per cent.

X.—Size of the Mesh of Netting for use against S. fasciata.

" Adults can get through 10 × 13 cotton netting ; they also pass 11 × 15 of the same material, and 14 × 14 wire gauze. No evidence of normal specimens escaping through 16 × 16 wire gauze occurred, but there is little doubt that the dwarf specimens caused by scarcity of food could do so. As suggested by the authorities of the Panama Canal Zone, for safety a mesh of not less than 18 × 18 should be used.

E. J. W.

Le Fanu (G. E. H.). **Some Observations on Fevers investigated in Quittah, March to June, 1914.**—*Yellow Fever Commission (W. Africa).* Reports on Questions connected with the Investigation of Non-Malarial Fevers in West Africa. 1916. Vol. 3. pp. 261–291. With 6 charts.

This paper consists of an analysis of 106 native cases : 81 children and 25 adults from seventeen years upwards.

Three cases (all adults) of yellow fever occurred amongst them.

Ninety-four of the remainder were cases of malaria and parasites were found in eighty-eight.

Out of 28 cases diagnosed as malaria and specially investigated for albuminuria, this condition was found in 23. It was also found in a number of children under 2 years of age, the youngest only 8 months.

E. J. W.

West Africa, Yellow Fever Commission. **Fourth and Final Report.** v + 274 pp. With 34 charts. 1916. London: J. & A. Churchill. [Price 5/– net.]

Since the outbreak of war the work of the Commission has suffered serious hindrance and accordingly it has been thought best to bring it, at any rate temporarily, to a conclusion.

This Fourth and Final Report is divided into five parts. Part 1 deals with the work of the Commission and briefly recapitulates the scope of the preceding Reports. These have been summarised in this *Bulletin*, the first two in Vol. 5, p. 71, and the third in Vol. 7, p. 285. Part 2 deals with the occurrence of various fevers, other than yellow fever among natives and Europeans in West Africa. Part 3 is devoted especially to yellow fever. Part 4 contains suggestions for further research and the general conclusions of the Commission respecting quarantine. Part 5 consists of appendices.

In regard to Part 1, the preceding Reports have, as stated, been already dealt with in this *Bulletin*. The conclusions concerning fevers other than yellow fever (Part 2) are given in the final conclusions of the Commission at the end of this review.

The first sections of Part 3 are concerned with the history of yellow fever on the West Coast up to the date of appointment of the Commission in January 1913. These sections traverse to some extent the ground covered in the Second Report of the Commission. In regard to the relation of the slave trade to the disease, the conclusion is that there was probably little or no connection between them.

The Report then goes on to consider the sporadic cases, the epidemics of 1913 and 1914, and three outbreaks which occurred after a prolonged period of quiescence in Southern Nigeria in September and October 1915. The following remarks are made with respect to the problem of the periods of quiescence between outbreaks which are so characteristic of the course of the disease :—

"The Commission has elicited no evidence which either proves or suggests that during these intervals the disease is continuously present either amongst the Europeans or amongst the native inhabitants of every place where its presence, at some time or other, has been recognised. It may be there, but the fact has not been *proved*, and it is, in their opinion, more probable that continuity is maintained by the existence of endemic areas and endemic foci than by its continuous and universal prevalence in a mild form amongst the native population, in the same way that Malaria may be said to be continuously and almost universally present.

"Such foci may also conceivably lead, through movements of man or mosquito, to the establishment of new or secondary foci, in which a similar 'smouldering' of infection may be maintained.

"The fact, which has been proved, over and over again, during the period covered by the work of the Commission, that the natives, as a whole, are susceptible to Yellow Fever, although they usually have it in a mild form, is conclusive against the theory of its universal prevalence amongst them. Having regard to the rarity of second attacks occurring in the same individual, it is clear that Yellow Fever belongs to that class of diseases which is characterised by the fact that, as a rule, immunity is conferred by a single attack. Exceptions occur, however, in the case of each of these diseases; and there is no reason to believe that the exceptions are more numerous in the case of Yellow Fever than with the others; indeed, it is probably true that they are less numerous. No one, indeed, denies that in the separate towns of each Colony, in which Yellow Fever has at some time appeared, there are periods during which it is not present among the Europeans. It is not, however, so easy to disprove its continued presence amongst the natives.

"The question of real interest is, 'What happens to the virus in these intervals of absence or inactivity?'

"Upon this it is easy to speculate and advance theories, but so long as we lack the means of identifying with certainty the minor manifestations of the disease amongst the natives, all such labour is useless.

"It may, however, be well to point out that we know just as little of the life-history of the virus of such a common affection as Measles, although the opportunities of observing and studying that disease have been immeasurably greater than with Yellow Fever. Measles appears in, say, a village, the epidemic runs its course and the disease disappears from the village, but not from the country. After an interval of varying duration it reappears, without in many cases the source of reinfection being discovered, yet it is not suggested that it has really been present in the village all the time.*

"But in a country in which a disease is constantly met with, the virus, if not again and again introduced, must in some way be kept in a condition of potential activity.

"Apart from some animal, or man, or the mosquito, and the native must be the man, and the *Stegomyia* the mosquito, we have no knowledge as to how this can be effected in such a disease as Yellow Fever, and naturally it is around man and the mosquito, both known to be concerned, that discussion centres as the possible 'reservoir.'

"How the solution of this difficult problem may possibly be reached is discussed in the section of the report dealing with 'Suggestions for further research' (*vide* page 253)."

The types of the disease as it is found in West Africa are then fully discussed, details with charts being given of mild and severe types in

* "We hear, however, that the suggestion is about to be made."

natives and Europeans. The question of symptomatology, diagnosis, and differential diagnosis are then discussed. The conclusions of the Commission in regard to albuminuria in Yellow Fever are :—

"(1) There is evidence that in severe attacks of aestivo-autumnal Malaria accompanied by pyrexia, albumen may be present in the urine.

"(2) That in such cases the amount of albumen is generally a mere trace.

"(3) That the albuminuria does not run a clinical course in any way similar to that observed in Yellow Fever.

"(4) That it is probably a pyrexial albuminuria, and is similar to that occasionally met with in Pneumonia, Typhoid Fever, and other acute febrile diseases.

"(5) That casts may be present, but are only found in very severe cases of malarial pyrexia, whereas they are commonly met with in Yellow Fever, and may, in that disease, be bile stained.

"(6) That the evidence from West Africa affords no support to the contention that albuminuria is of common occurrence in Malaria as observed in that country amongst Europeans.

"(7) That the frequent occurrence of urethritis, either acute or chronic, amongst the natives of West Africa, indicates the necessity for eliminating that source of error in all cases of pyrexia suspected to be due to Yellow Fever.

"(8) That the diagnostic value of albuminuria as a symptom of Yellow Fever remains unimpaired."

Under the heading "Hyperpyrexial Fever and Hyperpyrexia in Malaria and in Yellow Fever," the following remarks are made at the end of a selection of typical examples :—

"In each of these cases, although the evidence is defective in certain important particulars, it is, we think, difficult to arrive at any other diagnosis than that of Yellow Fever, which was the opinion formed by the medical officers, who either saw the case or made the post-mortem or pathological examination. If this view is correct, the cases are sufficient to establish the fact that hyperpyrexia may be a feature of Yellow Fever, and that a careful examination of the blood is necessary in all such cases before it is concluded that they are cases of Malaria. The defects in the evidence are due to the fact that all the cases occurred on board ship."

The conclusions concerning a disease (or diseases) of uncertain nature known to the natives by the names Uto-Enyin, Bayloo, and Bonke are :—

"1. That it occurs in a sporadic form and also in epidemics.
"2. That at least two different types of attack are recognisable.
"3. That one may cause death in five or six days.
"4. That the other may assume a sub-acute or chronic form.
"5. That the onset is sudden with acute febrile symptoms.
"6. That all ages and both sexes are affected.
"7. That it may be attended with a high mortality.
"8. That in some places it is recognised that one attack affords no protection against another, whereas in other places opinion is divided upon the question .
"9. That the finger nails may become yellow.
"10. That the most constant symptoms are :—
(*a*) Pyrexia. (*b*) Malaise. (*c*) Prostration. (*d*) Pains in various parts of the body. (*e*) Jaundice. (*f*) A dark colour of the urine. (*g*) Vomiting.
"11. That some, at least, of the cases are due to malarial infection."

The Commission recommends the following procedure in connection with the notification of cases of yellow fever and the declaration of a place as an infected place, and the declaration of Qarantine:

"(1) On the occurrence of a single case or of two or more cases of Yellow Fever, affecting either Europeans or natives, the Government of the

infected Dependency shall notify the Governments of the other Dependencies, British and others, in accordance with the present instructions 1, 2 and 3 set out above.

"(2) On the occurrence of two cases of Yellow Fever, non-imported, either in Europeans or natives, the Government of the infected Dependency shall exercise its discretion as to declaring any place to be an infected place, as defined in the Quarantine Regulations, having regard chiefly to :—

(i) The distance of the place or places infected from the coast or frontier ;

(ii) the interval, both in time and distance, between the first case and the second, as indicating the existence of a single focus of infection or of more than one such focus ;

(iii) the efficiency of the measures already taken to prevent the further spread of the disease within the Colony or Protectorate and the transmission of the disease to any other country or colony.

"(3) On the occurrence of three cases of Yellow Fever in any Dependency, the Government shall forthwith declare the Dependency an 'infected place' within the meaning of Regulation 1 of the Schedule of the Quarantine Ordinance.

"(4) On the receipt of the information described in the Instructions, as to the existence of one case or of two or more non-imported cases of Yellow Fever in any Dependency, the Governments of the other Dependencies shall exercise their discretion as to a declaration of quarantine against the infected Dependency, having regard (1) to the efficiency of the measures already taken to prevent the further spread of the disease, (2) to their knowledge of the sanitary conditions prevailing in the infected Dependency and the reputation of its administration, and (3) to the probability of the disease being transmitted to their own Dependency.

"If it is objected that to give a discretionary power as to declaring a place an 'infected place' up to three cases, instead of two as at present, is likely to favour the spread of the disease, it may be pointed out that, speaking generally, medical and sanitary administration is becoming increasingly efficient and the recognition of cases correspondingly more accurate; and also that the larger number is a presumptive indication, either of the existence of more than a single focus, or that the outbreak has not been brought under efficient control.

"Moreover, many declarations of quarantine would have been obviated by the change recommended, and the experience of the last few years has shown that no harm would have resulted had it been in force during that period. It may be pointed out that the suggested change does not limit the powers as to a declaration of quarantine by the non-infected Dependencies ; it merely allows the exercise of their discretion.

"There is no doubt that, in the past, cases of Yellow Fever have been concealed in order to evade the necessary declaration of infection, and that at least one of the Governments concerned, whilst declaring quarantine according to the present regulations, has established a land cordon against its neighbours contrary to the regulations dealing with the adoption of that measure.

"Possibly any Power which has acted thus in the past will continue to act in the same manner, but this should not, in the opinion of the Commission, prevent the adoption by the British Dependencies of less stringent regulations, which, at least as between each other, they may feel certain will be honourably administered."

Under "Suggestions for Further Research" attention is drawn to a scheme (Appendix 3) for a systematic research, by Dr. A. CONNAL, Director of the Medical Research Institute, Lagos, which cannot be summarised.

The General Conclusions at which the Commission have arrived are as follows :—

"(1) That the following fevers, other than Yellow Fever and Malarial Fever, are met with on the West Coast of Africa, viz. :—Typhoid Fever, Paratyphoid Fever, Pappataci Fever, and (possibly) Undulant Fever and

Seven Days' Fever, and possibly also Dengue Fever in a sporadic form, but that there is no evidence of the occurrence of widespread epidemics of any of these fevers in recent times.

"(2) That Malarial Fever is the most widely spread of the fevers met with in West Africa.

"(3) That Yellow Fever is an endemic disease of the British and other Dependencies on the West Coast of Africa. No sufficient evidence has been obtained that the disease occurs in the Republic of Liberia.

"(4) The number of cases diagnosed in the British Dependencies as Yellow Fever has not exceeded sixty in any one year during the last six years, nor one hundred and eighty in all; but the Commission are of opinion that many more cases have occurred.

"(5) That probably the continuous presence of the disease is maintained by the existence of endemic foci and areas or otherwise, rather than by its almost universal prevalence amongst the native population.

"(6) That the native population is not immune to Yellow Fever, although, as a rule, when attacked, the natives suffer from a milder type of the disease than the Europeans.

"(7) That the nature of the virus of Yellow Fever remains unknown.

"(8) That there is no evidence that Yellow Fever has been brought to West Africa during recent periods from outside Africa.

"(9) That epidemics of a disease have occurred in other parts of Africa presenting some features of a character similar to those met with in Yellow Fever, and that in these epidemics the mortality amongst the natives appears to have been much greater than usually now occurs when natives of the Dependencies on the West Coast are attacked by Yellow Fever.

"(10) That a disease of uncertain nature, known to the natives by various names, as for example, Bayloo, Uto Enyin, or Yellow Eyes, prevails in certain Dependencies, usually at a distance from the coast.

"(11) That the knowledge of the diseases, other than Malaria, common amongst the natives, both children and adults, inhabiting the 'bush' is very defective.

"The Commission feel that it is hardly necessary to emphasize the prime importance of a vigorous prosecution of anti-mosquito measures against all mosquito-borne diseases."

E. J. W.

CARTER (H. R.). **Immunity to Yellow Fever.**—*Ann. Trop. Med. & Parasit.* 1916. April 29. Vol. 10. No. 1. pp. 153–164.

Further evidence is produced in favour of permanent immunity from yellow fever after one attack.

The paper is largely an elaboration of one previously reviewed [this *Bulletin*, Vol. 7, p. 297], the statistics given therein being amplified.

The author summarises his epidemiological data as follows:—

"Thus, between the years 1888 and 1898, there entered Florida ports over thirty thousand people certified as 'Protected from yellow fever by previous attack or ten years' residence in an infected focus.' They came during the summer, May 1st to October 31st, from Havana, where yellow fever prevailed during this time, to Key West and Tampa—towns full of *Aëdes calopus* (Stegomyia) and of people susceptible to yellow fever. The time of passage was about eight hours to Key West, and twenty-four to Tampa. As no yellow fever developed in Florida during this period, there should have been no considerable number of secondary attacks infective to *Aëdes calopus* (*Stegomyia*) among these people.

"That yellow fever could be readily contracted from Havana by people susceptible to it is shown by the fact that during this time four hundred and fifty people from Havana, not certified as immune to yellow fever, yielded thirteen cases of yellow fever at a quarantine station.

"As thirteen cases of yellow fever, any one of which should have been infective to *Aëdes calopus* (*Stegomyia*), occurred among four hundred and fifty men who had not suffered from one attack, it would seem that if

recurrent attacks were common, enough cases should have occurred among the thirty thousand to have produced an outbreak in Florida. There was none.

"The above is also evidence that yellow fever carriers are not as common as are alleged by some modern observers; as is also the fact that the quarantine stations of the United States have for many years passed in a large number of people—well over a hundred thousand—from yellow fever ports with no evidence of their having infected *Aëdes calopus* (*Stegomyia*) in the United States."

Looked at from the clinical aspect, it is pointed out (and illustrative cases are quoted) that the proof of a second attack is difficult in the absence of a sign, pathognomonic for all cases of yellow fever, the mild and ephemeral as well as the severe.

E. J. W.

MacGregor (Malcolm Evan). **Resistance of the Eggs of *Stegomyia fasciata* (*Aëdes calopus*) to Conditions Adverse to Development.**—*Bull. Entom. Res.* 1916. May. Vol. 7. Pt. 1. pp. 81–85. With 3 figs.

The author refers to a former paper [summarised in this *Bulletin*, Vol. 7, p. 190] wherein he showed that dried eggs of *S. fasciata* which had left West Africa attached to leaves three and a half months before promptly hatched when put in water. Some were normal looking, others partially or wholly collapsed. Several generations of mosquitoes were raised. It was then found that the eggs were highly susceptible to destruction by desiccation and the author set himself to discover the conditions in which they resisted this process. If eggs laid on water or wet filter paper were removed they began to dry up and collapse and when again placed in water failed to develop. He conjectured that only those eggs which were laid out of water were able to resist desiccation but experiment did not confirm this. Such eggs were collapsed when examined. He then surmised that "not until the egg had been in contact with water for some time and the embryo partially developed was the shell rendered resistant to drying," and this proved to be the case. Eggs laid by ten mosquitoes in a Petri dish were divided into ten batches which were left in water for different periods, and then allowed to dry slowly. Of those left 15, 20 and 25 hours all collapsed after drying for 12 hours, of those left 37, 43, and 48 hours a percentage collapsed, and of those left 60, 65, and 70 hours none collapsed. These eggs had become resistant to desiccation. Photographs are given of collapsed and of normal-looking resistant eggs. The former failed to hatch, the latter hatched out six hours after being put in water. The author does not fail to note that "the degree of humidity of the atmosphere in certain tropical places may play an important rôle in allowing even freshly laid eggs when removed from the water to develop their resistant powers."

A. G. B.

PROTOZOOLOGY.

Fantham (H. B.) & Porter (Annie). **The Significance of Certain Natural Flagellates of Insects in the Evolution of Disease in Vertebrates.**—*Jl. Parasit.* 1916. June. Vol. 2. No. 4. pp. 149–166. With 2 text figs.

This paper contains the substance of previous ones published in England and noticed in this *Bulletin* [Vol. 5, p. 280; Vol. 6, p. 181; Vol. 7, p. 87]. A useful feature is a table of the various experiments, which is reproduced.

The summary is as follows :—

"1. Herpetomoniasis can be induced in various warm and cold-blooded vertebrates when the latter are inoculated or fed with herpetomonads occurring in the digestive tracts of various insects. The infection produced and the protozoal parasites found in the vertebrates resemble those of human and canine leishmaniases.

"2. An infection can also be induced in certain vertebrates when they are fed or inoculated with *Crithidia gerridis*, and both flagellate and non-flagellate stages occur therein, but no transition to a trypanosome was found.

"3. The following Flagellata have been proved pathogenic to warm-blooded vertebrates when the latter have been fed, or inoculated subcutaneously or intraperitoneally with them—*Herpetomonas jaculum*, *H. stratiomyiae*, *H. pediculi*, *H. ctenocephali*, *H. culicis* and *Crithidia gerridis*. The hosts used were mice of various ages, dogs, canaries, sparrows and martins.

"4. *Herpetomonas jaculum* and *Crithidia gerridis* have also been successfully fed or inoculated into cold-blooded hosts, namely, fishes (*Gasterosteus aculeatus*), frogs, toads, lizards (*Lacerta vivipara*) and grass-snakes (*Tropidonotus natrix*).

"5. The disease induced may run an acute or a chronic course. In the acute cases among our vertebrates the flagellate form of the parasite was the more obvious at death. In chronic cases, non-flagellate forms of the parasite were more numerous.

"6. Natural herpetomoniasis of a pigeon has been recorded by Drs. Edm. and Et. Sergent in Algeria. This affords a parallel case with the natural and induced herpetomoniasis of mice as recorded by us.

"7. The flagellate stage of *Leishmania donovani* in vertebrates is now known, and that of *L. tropica* in man has been known for some time. The links completing the evidence that a Leishmania is morphologically a Herpetomonas are thus complete. We believe that leishmaniases are invertebrate-borne herpetomoniases, and that these maladies have been evolved from flagellates of invertebrates (especially herpetomonads of insects), which have been able to adapt themselves to life in vertebrates.

"8. In areas where leishmaniases are endemic an examination should be made of all insects and other invertebrates likely to come into contact with men or dogs or domestic vermin like rats and mice, in order to ascertain if these invertebrates harbor herpetomonads. Preventive measures should be directed against such invertebrates, especially arthropods. Further, it is likely that members of all classes of vertebrates, and especially those members that are insectivorous, may serve as reservoirs for leishmaniases, or as they should preferably be termed, herpetomoniases. The virus may exist in such reservoirs in a very attenuated condition and so be difficult of detection. From these sources the herpetomonads may reach man by the agency of ectoparasites or flies, especially such as are sanguivorous."

A. G. B.

Table.—Results of the Experimental Infections of Different Vertebrates with Various Herpetomonas and Crithidia from Insects.

No. of Experiment.	Vertebrate Host.	Flagellate Introduced.	Mode of Introduction.	Duration of life of Host.	Effect on Host.	Forms of Parasites observed in the Vertebrates.	Remarks.
1	Wild mouse, *Mus musculus*, ♀	*H. jaculum*	Feeding	50 hours	Acute herpetomoniasis	Flagellate and non-flagellate	Young host.
2	Wild mouse, ♂	*H. jaculum*	Feeding	70 hours	Acute herpetomoniasis	Flagellate and non-flagellate	Young host.
3	Wild mouse, ♀	*H. jaculum*	Intraperitoneal inoculation	60 hours	Acute herpetomoniasis	Flagellate and non-flagellate	Young host.
4	Wild mouse, ♂	*H. jaculum*	Feeding	60 hours	Acute herpetomoniasis	Flagellate and non-flagellate	Host killed in extremis.
5	Wild mouse, ♀	*H. jaculum*	Feeding	84 hours	Acute herpetomoniasis	Flagellate and non-flagellate	Host killed when very ill.
6	Wild mouse, ♂	*H. jaculum*	Intraperitoneal inoculation	72 hours	Acute herpetomoniasis	Flagellate and non-flagellate	Host killed in extremis.
7	Adult mouse, ♂	*H. jaculum*	Intraperitoneal inoculation	Killed after 8 months	No symptoms of disease	Few non-flagellate	Spontaneous cure. No parasites found at autopsy.
8	Mouse, ♂	*H. stratiomyiæ*	Feeding	5 days	Herpetomoniasis induced	Non-flagellate and some immature flagellate	Young host.
9	Mouse, ♀, adult	*H. pediculi*	Feeding	72 days	Herpetomoniasis induced	Mostly non-flagellate, very few flagellate forms	Chronic infection.
10	Mouse, ♀, adult	*H. pediculi*	Fed on liver of No. 9	15 days	Herpetomoniasis induced	Non flagellate and flagellate	
11	Mouse, ♀, adult	*C. gerridis*	Intraperitoneal inoculation	40 days	Infection with *C. gerridis* induced	Flagellate and non-flagellate forms, the latter more numerous	Killed in extremis. Skin sore and alopecia at site of inoculation.
12	Mouse, ♀, adult	*C. gerridis*	Subcutaneous inoculation	2 months, then killed	Negative		
13	Mouse, ♂, adult	*C. gerridis*	Feeding	38 days	Infection with *C. gerridis* induced	Flagellate and non-flagellate, the latter predominating	
14	Dog, *Canis familiaris* ♂	*H. ctenocephali*	Feeding	Killed after 15 months	No marked permanent ill-effects	Non-flagellate	Young host. Spontaneous cure. No parasites found when killed.
15	Canary, *Serinus canarius*, ♀, adult	*H. jaculum*	Feeding	51 days	Chronic herpetomoniasis induced	Many non-flagellate, a few flagellate	Note chronic infection probably to be correlated with the presence of nonflagellate forms.

16	Sparrow, *Passer domesticus*, ♀, adult	*H. culicis*	Feeding	9 days	Acute herpetomoniasis induced	Flagellate and non-flagellate, the former predominating	Note acute infection, probably to be correlated with the presence of many flagellate forms.
17	Martin, *Chelidon urbica*, ♂, young adult	*H. culicis*	Feeding	12 days	Acute herpetomoniasis induced	Flagellate and non-flagellate, the former dominant	Note acute infection and many flagellate forms present.
18	Martin, ♀, young adult	*H. culicis*	Subcutaneous inoculation	2 days			Probably died of fright.
19	Canary, ♂, young	*H. jaculum*	Feeding with infected insect excrement	17 days	Herpetomoniasis induced	Flagellate and non-flagellate	
20	Martin, ♂, mature young	*H. culicis*	Feeding with infected insect excrement	32 days	Herpetomoniasis induced	Non-flagellate and a few flagellate	
21	Sparrow, ♀	*H. jaculum*	Feeding with infected insect excrement	Killed after 3 months		One parasite only seen during life	Spontaneous cure. No parasites found at autopsy.
22	Canary, ♀, adult	*H. culicis*	Fed on food contaminated with *H. culicis*	Killed after 80 days	Negative		
23	Grass snake, *Tropidonotus natrix*, ♂	*H. jaculum*	Feeding	20 days	Herpetomoniasis induced	Flagellate and non-flagellate	
24	Lizard, *Lacerta vivipara*, ♂	*C. gerridis*	Feeding	19 days	Infection with *C. gerridis* induced	Flagellate and non-flagellate	
25	Lizard, ♂	*C. gerridis*	Fed on infected liver of No. 24	6 days	Acute disease (crithidiasis)	Flagellate and non-flagellate	Second passage.
26	Lizard, ♀	*C. gerridis*	Intraperitoneal inoculation with infected heart blood of No. 25	Killed after 20 days	Slight infection	Non-flagellate	Killed for examination after 20 days. Third passage.
27	Frog, *Rana temporaria*, ♂, adult	*C. gerridis*	Intraperitoneal inoculation	29 days	Infection with *C. gerridis* induced	Flagellate and non-flagellate	
28	Frog, ♂, adult	*H. jaculum*	Intraperitoneal inoculation	54 days	Herpetomoniasis induced	Flagellate and non-flagellate	
29	Toad, *Bufo vulgaris*, ♂, adult	*H. jaculum*	Subcutaneous inoculation	40 days	Chronic infection	Non-flagellate and young flagellate	
30	Toad, ♀, adult	*H. jaculum*	Intraperitoneal inoculation	80 days	Negative	None	
31	Newt, *Molge vulgaris*, ♂, young adult	*H. jaculum*	Feeding	9 days	Apparently negative	None	Death by misadventure.
32	Stickleback, *Gasterosteus aculeatus*, ♂	*H. jaculum*	Feeding	2 days		None	
33	Stickleback, ♂	*H. jaculum*	Subcutaneous inoculation	5 days	Herpetomoniasis induced	Flagellate and non-flagellate	

Migone (L. E.). **Parasitologie de certains animaux du Paraguay.**—*Bull. Soc. Path. Exot.* 1916. June. Vol. 9. No. 6. pp. 359–364.

An examination of the animals living in rivers, swamps and places subject to inundation in Paraguay has been made by the author. The predominant parasites found were Haemogregarines, Trypanosomes, Myxosporidia, Microfilariae and Linguatulids. The present paper records their distribution in the different hosts and gives brief notes on some of them. Birds, fish, reptiles and mammals were examined.

Three birds were found to be parasitised. *Theristicus caudatus* (Bodd.) had a fairly large number of trypanosomes. They were about three times the length of a red blood corpuscle. Their nucleus was fairly large with a distinct karyosome. *Butorides striata* (L.) had a similar trypanosome, and another was found in *Tantalus americanus*. A list of birds in which no parasites were found is also given.

Five fishes were found to contain parasites. *Pseudoplatystoma coruscans* (Agass.) has haemogregarines in its blood, the skin is full of Myxosporidia, while the intestinal canal, peritoneal cavity, subpleural tissue and costal muscles are invaded by Linguatulids. *Doras armatus* and *Zungaro mangarus* have the same parasites. *Potamotrygon humboldti* (Rouillin) has Myxosporidia, and *Prochilodus argenteus* (Agass.) and *Hoplias malabaricus* (Bloch) have Myxosporidia and Linguatulids.

Among reptiles, Haemogregarines and Microfilaria were found in the blood of *Caiman solerops*, in whose abdomen and lungs cysts of Linguatulids were also found. Haemogregarines occurred in *Ameiva ameiva* (L.) and *Tupinambis teguixin*. The snakes *Eunectes murinus* (L.), *Spillotes pullatus* (L.), *Phyllodrias schotti*, *P. olfersii*, and *Lachesis neuwiedi* (Wagl) harboured haemogregarines.

The mammals infected were *Canis jubatus* (Desm.) *Hydrochoerus capybara* (L.), *Myocastor coypus* (Mol.), *Procyon cancrivorus brasiliensis* (Jhering), which all contained microfilariae.

Zungaro mangurus, *Dorus armatus* and *Pseudoplatystoma* have reniform haemogregarines with a central nucleus. They were only found in red blood corpuscles. Small schizogonic cysts occurred in the liver and spleen. Some spherical forms as well as the vermicular ones have been seen and may have a sexual significance.

Myxosporidia were most common in fish without scales. At first they were thought to be worms' nests. If dissected with care, a whitish tubercle could be removed. It was about 2 mm. to 3 mm. in diameter, and if crushed, a milky fluid, full of Myxosporidia escaped. The gills, spleen, liver and subpleural tissue all were infected.

A general account of the microfilaria and Linguatulids is also given.

A. Porter.

Fedorovitch (A. I.). **Hémoparasites trouvés dans un cas de fièvre chronique.**—*Ann. Inst. Pasteur.* 1916. May. Vol. 30. No. 5. pp. 249–250. With 2 plates.

During the antimalaria campaign on the coast of the Black Sea, the author observed an abnormal case of chronic fever in a ten-year old child. The stomach was enlarged, the spleen descended to the

umbilicus and the liver was hypertrophied. Certain parasites were found in smears of the blood from the ear. They were 3μ to 7μ long. The greater number were elongate, oval, with one drawn out extremity. Other small forms were rounded. The nucleus was central in the round forms, or was at the drawn-out extremity. It was usually round or oval, only exceptionally curved. The life-cycle of the parasite has not been found. The organism was not found in the splenic blood. The parasite resembles *Toxoplasma pyrogenes* Castellani [see this *Bulletin*, Vol. 3, pp. 521–2]. It is of interest to note that a similar parasite was found in the blood of a dog, the smear being taken at the fever crisis. The animal came from the same neighbourhood as the child.

The two plates show the various forms described.

H. B. Fantham.

Shaw-Mackenzie (J. A.). **The Action of Copper Salts on Protozoa.**—*Med. Press & Circ.* 1916. July 19. Vol. 102. No. 4028. pp. 50–52.

The action of injections of copper salts in cases of cancer led the author to try their effects on certain Protozoa and other micro-organisms. The copper salt of alanine, or amino-proprionic acid, and the corresponding salt of amino-acetic acid were chiefly used. Copper alanine is soluble in water, insoluble in alcohol, and soluble in serum; it also gives no precipitate with egg white, milk or caseinogen solutions. Preliminary investigations of its action on Protozoa and vegetable organisms have been made. When Opalina from the frog's rectum were placed in a solution of 1 in 20,000, they were killed in a few minutes, 1 in 100,000 killed in 10 minutes and 1 in 200,000 in 11 minutes. Nyctotherus, Balantidia and Nematodes in some of the preparations were not killed within the time limit set.

A concentration of 1 in 100,000 of copper alanine killed Paramoecium in 13 minutes. Hydra (Coelenterates) were killed in 30 minutes by the same strength. *Amoeba proteus* from pond water had its movements stimulated by a solution of 1 in 100,000 of copper alanine. If a solution of 1 in 40,000 were used the movements ceased after a time but were resumed after half an hour. With a concentration of 1 in 15,000, and 1 in 10,000, movements ceased, the organisms became rounded, but it was uncertain whether the amoebae were quiescent or dead. With strength of 1 in 1,000 and in 300, the amoebae were killed and fixed.

The author has had no opportunity of testing these drugs on the amoebae and bacilli producing dysentery, but thinks that the copper salts of the amino-acids might be employed locally by enemata, intramuscular injection or by the mouth. [Obviously, direct experiments on dysentery-producing organisms are needed first.] A. P.

da Fonseca (Olympio Oliveira Ribeiro). **Estudos sobre os flajelados parasitos dos mamiferos do Brazil.**—*Mem. Inst. Oswaldo Cruz.* 1916. Vol. 8. No. 1. pp. 6–40. With 4 text-figs. & 2 plates.

This interesting paper, which is an extension of two previous papers of the author on the flagellates of the intestines of mammals, should be consulted in the original by those interested in the subject. It is only possible to give a bare outline of the paper here. The author has made

a series of 252 autopsies of the higher animals, and has also examined birds, reptiles, batrachia and insects, while human dysenteric faeces and vaginal discharge have also been examined. A discussion of the classifications of the Flagellata proposed by HARTMANN and by ALEXEIEFF is given, and then a series of descriptions of the flagellates encountered follows. In each instance a list of synonyms, a brief historical summary and the general morphology of the organism are set forth.

Two species of Sphaeromonas were found in the rumen of the ox. *S. communis* showed much polymorphism in the position of its flagellum; it was generally about 10μ in diameter. *S. liebetanzi* was elongate and measured usually about 11μ by 5μ to 6μ. The Sphaeromonas multiply by binary and multiple fission.

Callimastix frontalis, from the rumen of the ox, *Bos taurus*, the goat, *Capra hircus*, and the sheep, *Ovis aries*, has usually a spherical body, 9μ to 10μ in diameter, but is very occasionally oval, when it is about 11μ by 7μ to 8μ. A group of many flagella, about 30μ to 40μ in length arising from numerous basal granules is present.

Five species of Chilomastix are described. *C. bittencourti* occurs in the caecum of the rat, *Mus* (*Epimys*) *norwegicus*; *C. caprae* in the rumen of *Capra hircus*; *C. cuniculi* in the caecum of *Oryctolagus cuniculus*; *C. intestinalis* in the caecum of the guineapig; and *C. mesnili* in human faeces. The descriptions of most of these organisms are well known.

Five species of Trichomonas have been examined: *T. caviae* from *Cavia porcellus* and *C. aperea*, *T. hominis* from man, *T. muris* from *Mus rattus*, *M. norwegicus* and the albino forms of *M. rattus* and *M. musculus*; *T. tatusi* from *Tatus novemcinctus*, and *T. vaginalis* from man.

A species of Trichomastix was found in the caecum of *Cavia aperea*, *C. porcellus* and *Dasyprocta aguti*.

Enteromonas hominis, a spherical form with three flagella, a single nucleus and one basal granule, reproducing by longitudinal binary fission was found in the faeces of a dysenteric patient.

Chilomitus caviae, *Octomitus muris*, *Giardia cuniculi*, *G. intestinalis*, *G. muris* and *Selenomonas ruminantium* have all been observed in animals in Brazil, where the research has been carried out by the author. A. P.

KOFOID (Charles Atwood) & CHRISTIANSEN (Elizabeth Bohn). **On *Giardia Microti*, sp. nov., from the Meadow Mouse.**— *Univ. California Publicat. in Zool.* 1915. Nov. 19. Vol. 16. No. 2. pp. 23–29. With 1 text-fig.

——. **On Binary and Multiple Fission in *Giardia muris* (Grassi).**— *Ibid.* pp. 30–54. With 5 plates and 1 text-fig.

These two papers appear to be further extensions of the earlier one by these authors [see this *Bulletin*, Vol. 8, pp. 18–19].

(1) The first paper contains an account of a new species of Giardia occurring in the meadow mouse, *Microtus californicus californicus*. Six hosts were examined, and three were infected. The parasites cause an inflammation of the intestine, whose walls become thin and flaccid.

The body of *Giardia microti* is from 10μ to 16μ long, and the diameter from 5μ to 7μ. The body is elongate pyriform in shape. A rhizoplast

passes from the karyosome through the centrosome at the anterior pole of the nucleus, thence to the blepharoplast of its side of the axostyle. The four pairs of flagella are long and subequal in length, being about 1½ times the length of the body. The parabasal bodies are curved tapering rods, usually lying parallel to each other.

The parasite is compared with other species of Giardia from which the organism is said to differ, more especially in the possession of curved parabasals. On this account the organism is named as a new species *G. microti*.

(2) The second paper deals with the life-history of *Giardia muris* studied in "culture mice," *Peromyscus maniculatus gambeli* (Baird) and *Microtus californicus californicus*. 163 of these animals were examined and 29 were found to be infected. Other animals examined were negative. The "region of frequent and maximum infection is the small intestine in the duodenum and occasionally near the caecum, though both above and below the latter it is often severe."

With regard to the morphology and life-history, the authors give a full and concise summary of their paper in the following words :—

"*Giardia muris* occurs in culture mice (grey and white), and in *Peromyscus*, but was not found in *Microtus* ; neither it nor other species were found in culture rats, Belgian hares, or coyotes, feeding where *Peromyscus* was taken. It causes chronic enteritis, especially in young hosts, with inflation and yellowish color of intestine.

"The normal trophozoite has a single axostyle, not two as heretofore described, an integrated neuromotor apparatus with fibrillar connections joining the karyosomes, centrosomes, blepharoplasts, flagella, parabasal bodies, and axostyle of the two cells in one more or less continuous system.

"Binary fission occurs abundantly and normally, with delayed plasmotomy. Normal mitosis occurs with intranuclear spindle, and four chromosomes in two groups. Precocious splitting of chromosomes in the prophase is followed by their fusion into a split skein from which the four chromosomes emerge on the equatorial plate. The blepharoplast and axostyle lead in mitosis.

"Multiple fission is of three types : (1) Free individuals form a plasmodium-like somatella of eight fully equipped zooids, in the formation of which the duplication of organelles keeps pace with nuclear multiplication. (2) Free individuals form eight zooids but nuclear multiplication precedes the division of the organelles. Encystment may follow. (3) Encysted single individuals form 8-zooid, 16-nucleate plasmodial masses with chromatic disintegration of organelles, the axostyles persisting longest. The small free zooids are not to be confused with *Hexamitus muris* Grassi, which is a distinct species. We find no evidence of an '*Octomitus*' stage of *Giardia*.

"There is tentative evidence of the fusion of two free individuals and also of copulation cysts which may be derived therefrom with the two gametocyte individuals back to back and of their maturation by two divisions. Chromosome reduction has not been detected in these divisions.

"The most striking feature of the development of the free, 16-nucleate, 8-zooid plasmodium, or somatella, is the preservation in each successive step of the process, of the fully equipped *binucleate individuals*. The *individuality* of the potential zooids is morphologically established and maintained, and there is evidence also of their functional independence in the independent motor struggles of each which result ultimately in plasmotomy. In the cases of multiple fission in cysts and free individuals in which nuclear multiplication outruns that of the other organelles, this individuality is more or less disrupted, or even lost. The possibility that some of these at least may represent involution or pathological states on the part of the parasite itself, should be borne in mind in all attempts to unravel the baffling significance of these protean aspects of this most interesting, suggestive, small, but by no means simple organism."

A. P.

Macaskill (D. C.). **Flagellate Infection in Caries of the Jaw.**—*Jl. Trop. Med. & Hyg.* 1916. June 15. Vol. 19. No. 12. p. 146.

The patient was a male Tamil, admitted to Kuala Kangsar hospital suffering from swelling and pain of the proximal joints of the limbs, and "caries of the right upper jaw, with a very foul-smelling discharge," which was persistent. When the pus was examined for possible pathogenic entamoebae, there were found "numerous flagellates, pear-shaped, with three flagellae at the broader end and an undulating membrane. The flagellates were very active and corresponded in size and appearance to *Trichomonas hominis* Davaine."

Treatment by emetine was given, half a grain "tabloid" by the mouth three times a day, and two days after this treatment began one-third gram was given subcutaneously. After one day's treatment with emetine, no flagellates could be found in the pus, and on continued treatment, the foul smell disappeared, the pus rapidly became less and the discharge ceased. It is thought that the caries of the jaw was resistant on account of the presence of the flagellates.

H. B. F.

Chagas (Carlos) & Torres (Magarinos). **Fecundação n'um flagellado de vida livre "*Prowazekia Cruzi*" (Hartmann & Chagas). Nota prévia** [The Cycle of *Prowazekia Cruzi*].—*Brazil Med.* 1916. July 15. Vol. 30. No. 29. p. 225.

The paper commences with a brief sketch of the genus Prowazekia and the points that distinguish it from Trypanoplasma. *Prowazekia cruzi*, described by Hartmann at the Institut Oswaldo Cruz in 1909, has been found easy for study, as it grows well on agar plates. Two to three days after sowing, flagellates are found on the culture media, and appear to be undergoing sexual processes. At first these forms were interpreted as being parasitic on other Protozoa. Then it was considered that they were really in process of fertilisation. Two flagellates were apposed. Fusion of the nuclei occurred, and also of the protoplasm. The organism then became elliptical and formed a double contoured membrane on its surface. Nuclear division and protoplasmic segmentation proceeded within the cyst, which ultimately contained 6 or 8 units. In the cultures, active forms were thought to be microgametes, while immobile or less active ones were designated macrogametes. Work on the organism is still in progress, in order to elucidate the complete cycle.

A. P.

McCulloch (Irene). **An Outline of the Morphology and Life History of *Crithidia leptocoridis*, sp. nov.**—*Univ. California Publicat. Zool.* 1915. Sept. 16. Vol. 16. No. 1. pp. 1–22. With 4 plates & 1 text-fig.

Large numbers of flagellates were discovered in the intestinal tract of the box-elder bug, *Leptocoris trivittatus*, common about the buildings of the University of Kansas. The hosts can be easily obtained throughout the year, and the mature insects show a hundred per cent. infection.

The morphology of the flagellate form is of the usual crithidial type. An axostyle passing from the basal granule to the posterior end of the body, is considered to be present, as is also a rhizoplast. The " kinetonucleus " is also considered to consist of two large granules side by side, though " at still another angle the " kinetonucleus " may present the appearance of a single round chromatin mass." Longitudinal division has been observed. Observations of living material shows that in division of the flagellum a process of splitting occurs rather than a new outgrowth, and stained preparations go to confirm this.

Two types of preflagellate forms are described, a non-flagellate form enclosed in a capsule-like structure, and a flagellated form which develops from small round spores. The non-flagellate form shows no axostyle. Non-flagellate forms in juxta-position to flagellate forms have been observed. " Following the appearance of the preflagellate forms just described, there are great masses of Leishmania-like forms found in the lumen of the stomach. The evidence points to the fact that the flagellates described above undergo a multiple fission process, either intracellular or extracellular. Direct evidence of the intracellular forms has not yet been found in sections of the epithelial lining of the stomach but the so-called tailed and tailless spheres (Minchin and Thomson, 1915) have been found in cellular masses on smear preparations." Plasmodial masses and multiple fission forms also have been seen.

Flagellate forms vary in length from 20μ to 40μ and from 1·5μ to 3μ in breadth. Extremely long forms have been found in the ileum and colon. The post-flagellate stages have been found in the rectal region. " As the insects become mature the rectum is apt to be lined with attached flagellates and the lumen filled with a different type of the parasites, the free forms." The latter present much morphological variation.

The exact conditions under which the insects become infected are not definitely known. Under laboratory conditions, some very hungry insects were seen to suck the contents from the digestive tracts of other weaker ones. No hereditary infection was found. The infected regions of the bug were the stomach, mid-intestine, ileum, colon and rectum. The rest of the organs gave negative results.

A. P.

Migone (L. E.). **Un nouveau flagellé des plantes :** *Leptomonas Elmassiani.—Bull. Soc. Path. Exot.* 1916. June. Vol. 9. No. 6. pp. 356–359.

The author investigated the new flagellate when on an excursion along the banks of the Rio Salado, near Assomption, dealing with an outbreak of " Mal de Caderas " among the capybara.

The flagellate was found in the sap of a member of the Asclepiadaceae, *Araujia angustifolia*. All parts of the plant, stem, climbing branches, leaves, flowers and fruit contained the organism. The parasites did not disappear during the winter, when the plant was bare. When the parasitised plants were transplanted to another locality, they grew well, but gradually lost their parasites. Plants grown from the seeds of an infected plant were not infected. When

the stem or leaf of the plant is broken, a disagreeable odour is given out, and no animal has been seen to touch it nor insect to live on this plant.

The parasite is very fragile. Heat was found to be the best fixative. Giemsa stain was chiefly used. A nucleus and blepharoplast were present; the flagellum stained better with aniline gentian violet than with Giemsa. No undulating membrane was seen. The parasite divides longitudinally. The length of the body is 14μ to 15μ and the breadth 1·5μ to 2μ.

Inoculations of the parasites to animals have so far failed, as the animals have succumbed to septicaemia due to other causes. As the organism is shorter than that described by Lafont, and occurs in a member of the Asclepiadaceae, it is named *Leptomonas elmassiani*.

A. P.

Brug (S. L.). **Morphologische Studien an *Proteosoma praecox*.**—*Arch. f. Schiffs- u. Trop.-Hyg.* 1916. Vol. 20. pp. 289–306. With 2 coloured plates.

The author gives an account of the morphology and life-cycle of *Proteosoma praecox*, which he studied in canaries. The work was undertaken with a view to confirming Hartmann's inclusion of the Proteosoma in the group Binucleata [now abandoned]. In most respects, the morphology of the parasite described is of the usual type, but the author considers that he has demonstrated a blepharoplast in the young schizont, the structures being compared shortly with the parasite of kala azar. They have not been found with certainty in the half-grown or older schizonts, sexual forms, oökinetes or sporozoites. Figures in illustration of the binucleate condition are included on the plate [but the author does not seem to have excluded the possibility of a natural infection of herpetomonads co-existing with the Proteosoma].

A. P.

de Mello (Froilano). **Quelques considérations sur les affinités zoologiques du genre "Haemocystidium," avec description d'une espèce nouvelle.**—*Anais Scientif. da Faculdade de Med. do Pôrto.* 1916. Vol. 3. No. 1. 11 pp. With 1 coloured plate.

The present paper commences with a brief review of the discovery of the parasites named Haemocystidium by Castellani. The author quotes the opinion expressed in his textbook by Minchin that the genus was provisional. The author and his students bring forward some observations that they believe to show that the organisms known as Haemocystidium are really members of the group Haemoproteus, and that the two organisms belong to the same type of Haemocytozoa.

The main new feature of the work is the observation of the flagellate stage in the male gamete of Haemocystidium in the blood of lizards. A description is given of a new species of Haemocystidium in the blood of the lizard *Hemidactylus brookei* Gray. The animals were heavily infected. The red cells were hypertrophied if infected, were to some extent dehaemoglobinised, the nucleus was displaced, and as the parasite developed, it gradually

disappeared by a process of karyolysis. The male gametocyte has a nucleus showing three clear chromatic granules as a rule. Blackish brown pigment is present. The pigment is contained in one, rarely two, vacuoles. Flagellate male gametes have been observed but no details are given.

The female gamete has much pigment composed of numerous granulations, scattered over the entire surface.

Young forms are circular and possess no pigment.

The plate shows the forms of the gametocytes, but it is to be regretted that no figures of the male gametes, on which the new classification at present is founded, are given. A. P.

de Mello (Froilano) & Braz de Sa (L. J.).—**A Contribution to the study of Haemoprotozoa in Portuguese India.**—*Indian Jl. Med. Res.* 1916. Apr. Vol. 3. No. 4. pp. 731–737. With 1 coloured plate.

The authors, writing from Goa, refer to the accounts given in various textbooks of the life-cycle of the Halteridia as given by Schaudinn, and to the old controversy as to whether Halteridia were part of the life-cycle of trypanosomes. They have studied the Halteridium of the pigeon, and find no flagellate stage in its development. Their results confirm fully those of Acton and Knowles, except in minor details, such as the further disintegration of the chromatin masses in nuclear division. In schizogony, the merozoites occur in the erythrocytes as small irregular bodies. When full grown, the schizonts are about a quarter the size of the erythrocyte. Small brownish-yellow granules of pigment are present. The parasite becomes free in the plasma, loses its pigment and becomes circular. The authors name this form the Acton body. Multiple division of the nucleus occurs, and ultimately all the nuclei become chromidial dust. The Acton body is then renamed the merozoblast, as it gives rise directly to merozoites. Gametogeny is like that described by Acton and Knowles.

Haemoproteus moruony, n. sp., is described from the blood of a bird, *Copsychus saularis*, the poetic common name for which is "moruony." The cycle in the bird is like that in *H. columbae*, but all stages of its development may be found in the circulating blood of its host. Seventeen birds were examined and all were infected. No biting fly or arthropod was found on the birds.

Eleven specimens of *Vespertilio muricola* have also been examined. Two were infected with Plasmodia. Young bacillary forms of the parasite occurred in the blood. In schizogony, the chromatin divided early, and six merozoites were constantly produced. The gametocytes were circular or ovoid. All the bats had ectoparasites belonging to the Nycterobiidae, but nothing was found when these wingless Diptera were dissected.

The authors had not access to much of the literature relating to Plasmodia in bats, but should the Plasmodium of *Vespertilio muricola* prove to be a new species, they suggest the name *P. mackiei* for it.

[It is to be regretted that the authors have introduced new terms which are not needed in describing the trophozoite and schizont of a Haemoproteus.] A. P.

Plimmer (H. G.). **Notes on the Genus Toxoplasma, with a Description of Three New Species.**—*Proc. Roy. Soc.* 1916. Aug. Vol. B. 89. No. B. 616. pp. 291–296. With 2 plates.

The present paper contains a short historical survey of the genus Toxoplasma, with notes on new unnamed species. The author considers that the Toxoplasms are more nearly allied to the Haemogregarines than to other Haemosporidia. They may occur in mononuclear leucocytes or free. They produce marked wasting and considerable blood destruction. The organisms are not encapsuled. They possess a karyosomatic nucleus, which may become granular.

Toxoplasms are now described from the fossa, *Cryptoprocta ferox* from Madagascar, the host dying at the Zoological Gardens, London. The fossa was very emaciated, the kidneys and lungs were congested, while the blood contained poikilocytes and nucleated erythrocytes. A few Toxoplasma were present in the blood, many were present in the lung blood, pleural and peritoneal exudate and bone marrow, the latter containing schizonts.

The blue-tailed fruit pigeon, *Carpophaga concinna*, from the Aru Islands, contained large numbers of toxoplasms in the blood and lung exudate. The nucleus of the parasite was "generally single and definite, and was not broken up into granules."

Say's snake, *Coluber melanoleucus*, from Mexico, was very wasted and anaemic when examined. Toxoplasms were present in small numbers in the lung exudate, and in enormous numbers in the liver.

Toxoplasms have also been found in a Pied Bush Chat, *Pratincola caprata*, early stages of schizogony being found in the large endothelial cells of the lungs.

Two plates of somewhat poor and unconvincing figures illustrate the paper.

A. P.

Carini (A.) & Migliano (L.). **Sur un Toxoplasme du cobaye** (*Toxoplasma caviae*, **n. sp.**).—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 435–436.

The authors, writing from Sao Paulo, Brazil, have found a spontaneous infection of Toxoplasma in a young guinea-pig, four weeks old, the infection having fatal results. Prior to death there were no symptoms noted. At autopsy, the spleen was found to be three to four times the normal size, friable and somewhat harder than usual. The liver was enlarged and hyperaemic, the lungs congested and the intestine red, with engorged blood vessels. Smears were made of all organs, and toxoplasms were found therein. They were 5μ to 8μ by 2μ to 4μ. Slightly curved, pyriform and oval forms were usual. The parasites were usually free, occasionally endocellular. Some multiplicative forms were present.

Two pigeons were inoculated subcutaneously with emulsions of organs of the guinea-pig. Both died after 17 days, but until the fifteenth day no symptoms were noticed. For the last three days, the birds showed great thirst, had no appetite, had diarrhoea, and were

very ill on the last day. At autopsy, the lungs showed numerous grey spots, the liver was enlarged and hyperaemic, and numerous parasites were found in the lung and in the liver.

The name *Toxoplasma caviae* is given provisionally to this parasite, though the authors express the opinion that probably the organism may be found to be identical with that in the dog and rabbit.

A. P.

van Saceghem (R.). **Observations sur des infections naturelles par *Toxoplasma cuniculi*.—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 432–434. With 1 fig.**

Natural infection of rabbits born at Zambi, Lower Congo, has been observed by the author. The rabbits were $2\frac{1}{2}$ to 3 months old, and only young rabbits were in the hutch. The infection was always fatal. Profound anaemia, with white conjunctiva, was usual. The rabbits fed badly and did not move about. Paresis of the limbs followed and death ensued. The spleen was hypertrophied, 10 cm. long and 2 cm. broad, sprinkled with white spots and ecchymoses. The liver and the lungs were similarly spotted. At first sight, the appearance suggested miliary tubercle. The blood showed basophilia and lymphocytosis. No parasite other than Toxoplasma was found in the peripheral circulation.

Characteristic *Toxoplasma cuniculi* was found in the spleen smears. Some more or less rounded forms were also noted. The average length of the parasites was 6μ to 7μ. Some dividing forms measured as much as 21μ. The position of the nucleus was very variable. Sometimes the nucleus contained many chromatic masses. One or two very distinct chromatic masses were seen in some, and the author suggests that these may be micronuclei.

The parasites were found in many large mononuclear leucocytes in the spleen, where schizogonic forms were also found. Young merozoites were set at liberty by the rupture of the large mononuclears, and the parasites in such cells are therefore considered to be usually schizonts.

A. P.

Crawley (Howard). **The Sexual Evolution of *Sarcocystis muris*.—*Proc. Acad. Nat. Sci. Philadelphia*. 1916. Jan. pp. 1–43. With 5 plates.**

This paper should be consulted in the original by those interested in the subject. It is impossible to give a detailed analysis of it, and perhaps the best plan is to reproduce the author's summary, which is as follows:—

"(1) The spores of *Sarcocystis muris*, ingested by a mouse, may reach the posterior part of the small intestine within one hour.

"(2) Invasion of the epithelium cells of the intestine may also take place within the same time.

"(3) Upon reaching the lumen of the intestine, the spore rapidly undergoes changes. The nucleus becomes larger and more conspicuous, and a distinct nuclear net becomes evident. The granules characteristic of the spore as it occurs in the cyst either disappear or become much less evident. Further changes, however, do not take place unless the spore gains an intracellular situation.

"(4) The spores are sexually differentiated, but it does not appear to be possible, at the outset, to distinguish between the males and females.

"(5) Within the mouse cells the changes undergone by the males, or microgametocytes, begin to be evident at the end of 1½ to 2 hours.

"(6) These changes are, first, a further increase in the size of the nucleus accompanied by a further development of the nuclear net, and, second, degeneration and ultimate disappearance of the cytoplasm. The cell contours become rough and irregular, vacuolization occurs, the cytoplasm becomes reduced to two masses of debris lying at the ends of the nucleus. These finally disappear, the entire process usually being completed at the end of six hours. The micro-gametocyte is thus reduced to its original nucleus, which, however, is of approximately the same size as the original spore.

"(7) Conspicuous internal changes next take place, which modify both the morphology and chemistry of the parasite. They may be considered under three headings, but they all take place more or less simultaneously.

"(*a*) The chromatin appears to suffer a loss in actual bulk, but alters in staining reaction from acidophil to basophil.

"(*b*) From occurring in large irregular masses or distributed along the threads of the linin net in strips of bands, the chromatin is reduced to granules which become progressively smaller and smaller and at the same time display a greater and greater affinity for chromatin stains.

"(*c*) These granules finally assemble in clusters around the periphery of the organism.

"(8) The next step is the solidification of these granular clusters into rounded, solid balls. These balls next elongate and become minute, thread-like bodies, which are the microgametes. This stage may be found in mice killed from 9 to 18 hours after inoculation. It is very rare in the shorter of these two periods, but has apparently passed its acme at the end of 18 hours.

"(9) The females go through with their development side by side with the males, but there are no such conspicuous changes and the early female stages are much like the spore which has just entered the cell.

"(10) In the course of a few hours, however, the females can be picked out, appearing as broadly oval cells, relatively shorter and broader than the original spores. The cytoplasm is all retained and assumes a rather dense alveolar texture. The nucleus shows no evident increase in size. The nuclear net does not develop as it does in the male parasite, but the chromatin concentrates into a single large karyosome which maintains an acidophil rather than a basophil staining reaction.

"(11) In the 6- to 15-hour periods, phenomena are seen which seem best interpreted by regarding them as maturation. Irregular chromatin granules appear in close association with the nuclear membrane. Later these granules pass out into the cytoplasm, and finally disappear.

"(12) The mature female, or macrogamete, may be found in mice killed from 11 to 18 hours after inoculation.

"(13) Finally, in the 18-hour stages, macrogametes may be found which in some cases show minute, thread-like bodies upon their surfaces, and in others contain within their substances small solid chromatic bodies, one in each case. These appearances are regarded as warranting the interpretation that fertilization takes place."

A. P.

Crawley (Howard). **The Zoological Position of the Sarcosporidia.**—*Proc. Acad. Nat. Sci. Philadelphia.* 1916. June. pp. 379–388.

The author has previously shown that the spores of *Sarcocystis muris* are sexually differentiated and that the sexes develop in the intestinal cells of the mouse, fertilisation occurring in from 9 to 18 hours after ingestion. The events following on fertilisation have not been traced. He reviews the work of Erdmann and of Nègre, the experiments of the latter worker in infecting animals by means of sarcosporidian

spores in faeces having been repeated and confirmed in America. The work of Negri and Bertram is also discussed, and the author mentions that Fantham found two types of spores in *Sarcocystis colii*. He then reviews the classification of the Sarcosporidia among the Sporozoa, in connection with his discovery of sexual forms. He considers that the earliest stages of the sarcocysts as depicted by Bertram and Negri may be only sporoblasts. The sarcosporidian cysts is said to be derived from a single cell, such having been found in the heart cells of a sheep infected with *S. tenella*. The several stages of *Sarcocystis muris* are compared with those of "an ideal member of the Coccidiomorpha." It is considered that the evolution of the microgametes and the macrogametes of the organisms compared are parallel. The events following on fertilisation in the Sarcosporidia are as yet unknown. A product of the zygote, however, invades the muscles of the host, and also probably develops into the cysts. If such is the case, the parallel holds. The end-results of the development in the muscles is the same, since a large number of potential sexual forms are evolved.

It is considered that the sarcosporidian spore is the homologue of the coccidiomorphan merozoite; the sexual stages are alike, while the sarcosporidian sporoblast may correspond to either the sporozoite or the trophozoite of the Coccidiomorpha. From the foregoing considerations, the author concludes that the Sarcosporidia are not members of the Neosporidia, but belong to the Telosporidia, and to the Coccidiomorpha. He adds an interesting speculation as to the probability of the Sarcosporidia having two hosts, and suggests that a carnivorous animal becomes infected by eating a parasitised herbivorous one, while the herbivorous host becomes infected by ingesting spores voided with the faeces of the infected carnivore.

A. P.

Franco (Enrico E.) & Borges (I.). **Sur la sarcosporidiose bovine.**—*Arq. Inst. Bact. Camera Pestana.* 1916. Vol. 4. No. 3. pp. 269–289. With 11 plates.

The sanitary inspectors at the municipal abattoir at Lisbon, have long recognised a malady affecting cattle, especially oxen, in the province of Alentejo. Cattle so affected were unfit for food. Since 1885, 67 out of 339,636 oxen were condemned on account of sarcosporidiosis. The present authors have worked on the subject since 1912. They have studied six cases. The material used consisted in five cases of pieces of aponeuroses, and in the sixth, in addition, two large bands of skin, one from the head and the other from the thigh were used.

Macroscopically, the lesion consisted in little spherical grains, about 0·25 mm. to 0·4 mm., found especially in superficial aponeuroses and, more discretely, in the subcutaneous tissue. The grains were yellowish white, and suggestive of sand. Sometimes the nodules were so abundant that a large granular mass was formed. In generalised infections, they occurred on all parts of the head, body, trunk and limbs. The greatest number were found on the thighs and flanks. The malady is believed to be due to the organism that was named *Sarcocystis besnoiti* by Marotel. The gross external symptoms have not been so marked as in the cases of the earlier investigator, but it is

possible that the malady had not reached its last stage when it came under the observation of the present workers. All the animals were thin, but no external signs that they were infected could be detected in the living animal.

Macroscopically, the size of the cysts varied from 250μ to 400μ. Nearly all the granulations possessed a central clear space in them. The granular part was surrounded by a clear part. Microscopically, there were three parts to each cyst, an external membrane, an internal, cellular membrane, and spores. The external membrane was of uniform thickness in each cyst, but differed in thickness for different cysts. It was structureless. The internal membranes consisted of a continuous protoplasmic layer, finely reticulate, with numerous nuclei, resembling endothelium. Spores are only found within the cysts, and can only be set free by crushing the cysts. In the fresh condition, the spores (sporozoites) show no flagella. They move slowly by contraction and flexion. The extremities were rounded, and one end was always more rounded than the other. The majority were banana-like. The average dimensions were 4·5μ to 6·5μ long, by 1μ to 1·8μ broad.

The pericystic tissue consisted of connective tissue cells, eosinophile leucocytes, and plasmatic cells (plasma cells, plasmocytes, and hyper-cyto-chromoplasmatic elements).

Examination of the skin macroscopically shows little. There was no desquamation, the hairs were normal, there were no ulcerations. In the thickness of the skin numerous very small, translucent granulations were found. The muscles immediately beneath the spots also had some of the granulations. The cysts were found, when examined histologically, to be present in the dermis, in the adjacent subcutaneous tissue, and in fewer numbers in the adjacent muscles. They were not present in the epidermis.

Evidence of cure was the same in all the cases. Sometimes capsules were found torn and partly filled with new connective tissue. In others, the contents had become fused into a homogenous block in which only a few remains of spore nuclei could be distinguished. The authors have never seen any evidence of phagocytosis of the spores. They find rupture of the external capsule with total or partial destruction of the internal capsule, and subsequent infiltration of cellular elements into the capsule.

Attempts to transmit the affection to rats and mice by the mouth and by subcutaneous inoculation have been negative. The origin of the malady also is unknown.

As the parasites presents certain features different from other species of Sarcocystis, the authors create a new genus for it, naming the organism *Besnoïtia besnoïtia.*

A. P.

AMOEBIASIS AND DYSENTERY.

Amoebiasis.

Thomson (David) & Thomson (J. Gordon). **Protozoological Researches, including Investigations on the Sand in Egypt, undertaken to elucidate the Mode of Spread of Amoebic Dysentery and the Flagellate Diarrhoeas: with Conclusions regarding the Sanitary Measures necessary to prevent these Diseases.**—*Jl. Roy. Army Med. Corps.* 1916. July. Vol. 27. No. 1. pp. 1–30. With 3 plates.

Part of the present paper covers the same ground as certain of the earlier works of these authors, working alone or in collaboration [see this *Bulletin*, Vol. 8, 115]. It is therefore not necessary to cover this ground again. The vast majority of the Protozoa found in the sand of Egypt are considered by the authors to be harmless. A large part of the memoir deals with the morphology and life-history of *Amoeba limax*. It was studied on cultures on agar that had flowed over a slide, the whole slide being fixed and stained. In agar cultures, the cysts were found at the centre and the vegetative forms ultimately at the edge of the growth. There is a discussion as to whether sporogony occurs within the cysts of *A. limax*, the conclusion apparently being that it is doubtful whether sporogony or autogamy occurs.

A Bodo and a Prowazekia occurred in the sand and also at times have been found in human faeces and in horse dung. *Amoeba proteus*, *A. verrucosa* and *A. diploidea* were found. *Astasia margaritifera*, a flagellate belonging to the Euglenoidina, occurred, and some *Scenedesmus caudatus* and *Pandorina merina* also were observed, the latter being freshwater algae.

Ciliates described as "balantidium or nyctotherus" were also present. Free and encysted forms occurred, and the cysts gave rise to four daughter forms.

By experiments it was shown that the cysts of the Protozoa found were very resistant to external agencies such as heat, sunlight and water. They were also resistant to chloride of lime in much larger quantities than are used in water sterilisation.

The paper concludes with a short, very practical resumé of the sanitary measures necessary for the prevention of amoebic dysentery and the flagellate diarrhoeas [see this *Bulletin*, Vol. 8, pp. 115–116].

A. Porter.

Cannata (S.). **Sulla dissenteria amebica nell' infanzia.** [Amoebic Dysentery in Infancy.]—*Pediatria* 1916. June. Vol. 24. No. 6. pp. 359–362.

An article drawing attention to the possible occurrence of amoebic dysentery in children of tender years, in places where it is endemic. Olinto de Oliveira met with 100 cases in children between 2 and 15 years of age out of 6,000 examined in Brazil (in 1906), while Bobillier in France has recorded cases in infants between 8 and 23 months of age [reference not given]. The dose of emetin given by the latter is one centigramme twice daily for children between one and two years of age, and half that quantity for infants under one year.

J. B. Nias.

Ravaut (P.) & Krolunitski (G.). **Les kystes amibiens. Importance de leur recherche dans le diagnostic et la pathogénie de la dysenterie amibienne.**—*Presse Méd.* 1916. July 3. Vol. 24. No. 37. pp. 289–291. With 2 text figs.

Active entamoebae are only found for a short period during the acute attack and occasionally between the crises. As they soon perish the examination must be done in close proximity to the bedside. It is the detection of the cysts of *E. histolytica* with which we have to deal most frequently. If they are very scanty a saline purge, a purgative wash or, best of all, an intravenous injection of 1–4 cgm. of mercury cyanide will increase their numbers. The cysts will remain in a good state of preservation for at least two days in the stools. The authors have found that by the addition of formalin to faeces containing them the cysts will retain their characteristic microscopic appearance intact for an indefinite length of time. This is very useful if the faeces have to be sent long distances for investigation or if it is expedient to postpone the search for cysts. Amoebic dysentery has suddenly become an important disease in France as a result of the war. Cysts have been discovered by the authors in 5 per cent. of apparently healthy individuals in one district in France, compared with 8 per cent. found by Mathis in an endemic area in the colonies. In addition a number of cases of acute amoebic dysentery have occurred in people who have never been out of France; the detection of cysts with a view to the treatment or isolation of carriers is, therefore, of paramount importance. The authors discourse upon the morphology of *E. histolytica* and other organisms with which it may be confounded. The accompanying figures have been drawn to illustrate the salient points of difference.*

E. E. Atkin.

Ravaut (Paul) & Krolunitsky (Georges). **Sur quelques formes cliniques de dysenterie amibienne autochtone observées au cours de la petite épidémie de la région du Nord.**—*Bull. et Mém. Soc. Méd. des Hôpit. de Paris.* 1916. June 9. Vol. 32. 3 ser. No. 19–20. pp. 916–926.

This is an attempt to class amoebic dysentery under three artificial headings.

Septicaemic type.—Three cases are cited.

(*a*) A soldier, 39 years old, developed dysentery after inhabiting trenches previously occupied by colonial troops. Emetin and anti-dysentery serum did no good. The patient's serum gave a slight agglutination at 1 : 50 dilution with Flexner-Y bacillus. [This is too low a dilution to be diagnostic.] Petechiae and a purpuric rash made their appearances, in addition to which several haemorrhagic abscesses formed which were sterile on cultivation. Amoebae were not found in the faeces, but the man had been having silver nitrate washes. This case proved fatal and the autopsy confirmed the diagnosis.

(*b*) In another case *B. dysenteriae* Shiga was found in the stools. Antiserum however failed to relieve the condition and a further search revealed the presence of amoebae. Emetin and salvarsan seemed to do good but the cachexia continued. Eventually the patient succumbed three months after admission to hospital.

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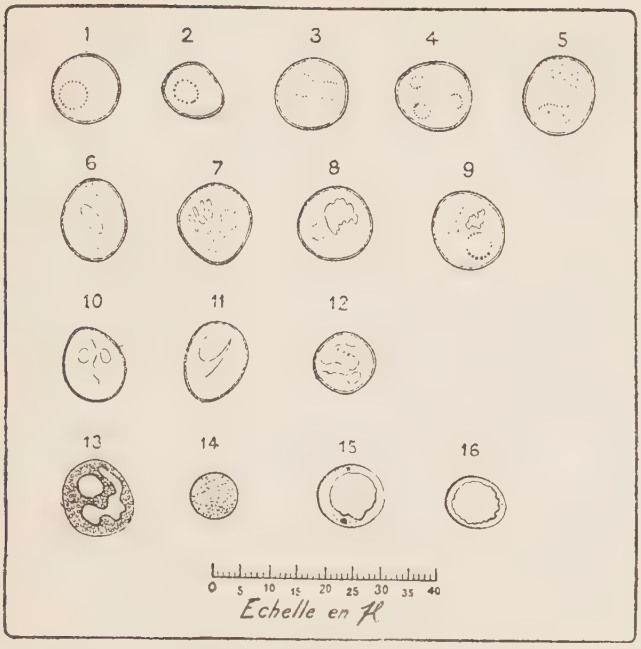
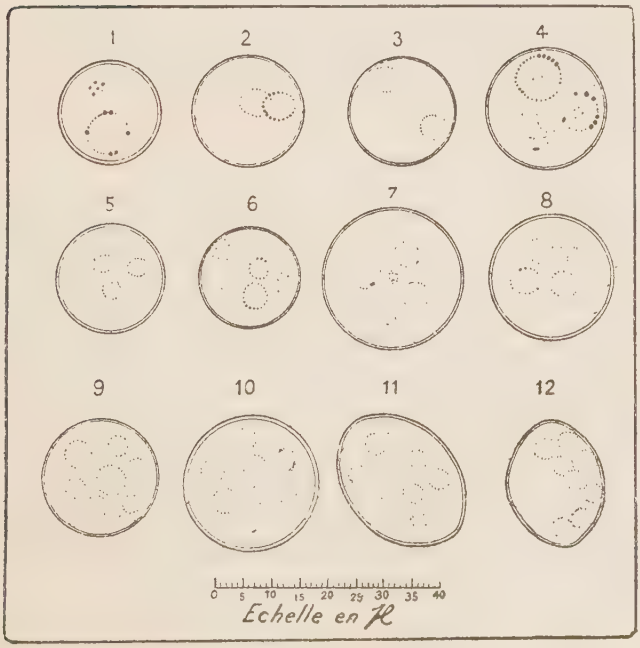
Plate 1.



1—9. Cysts of *E. histolytica*.
1–5. Cysts with one to four nuclei.
6–9. Cysts enclosing chromidial masses.
10—12, Cysts of *Lamblia intestinalis*.
13 & 14. White and red cells.
15 & 16. *Blastocystis hominis*.

Plate 2.



1—12. Cysts of *E. coli* with one to eight nuclei.

In addition to the intestinal lesions, the suprarenals were affected. The medulla could no longer be distinguished, and the cortex was softened.

(*c*) In this case Shiga and *E. histolytica* cysts were both found in the stools. Anti-dysentery serum was without effect, but salvarsan quickly cured the patient, which is in accordance with the now established fact that when the two organisms are associated the amoeba assumes the chief rôle.

All these cases appeared to belong to a septicaemic type, the chief features of which are, fever, hiccough, vomiting, dysenteric stools, cutaneous haemorrhages and sanious abscesses. The septicaemic condition is put down to some secondary invader at present unknown.

Suprarenal type.—As an illustration of this a case is cited of a man who had spent eight months in Tunis where he was quite healthy. He was sent to the Belgian front and developed dysentery. He exhibited all the signs of suprarenal failure—low vascular tension, etc. A litre of serum containing 2 mgm. adrenalin was introduced into a vein, which was repeated next day. On the third and fourth days only half the amount of serum in conjunction with 2 mgm. of adrenalin was given. Subsequently immobile amoebae containing red blood cells, in process of forming cysts were discovered. Emetine and salvarsan effected a cure.

Obscure cases.—Under this heading are classed the cases which are clinically much more indefinite. They are often associated with the cystic stage of the amoeba.

[The authors consider they have established for the first time that amoebae can cause lesions of the suprarenal glands. There is absolutely no proof of this here. In the writer's opinion it is much more reasonable to suppose that *B. dysenteriae* Shiga is the real cause. On the authors' own showing (see previous summaries) this organism is frequently associated with *E. histolytica* and it is known to form a toxin which attacks suprarenal tissue. No effort was even made to exclude the Shiga bacillus.]

E. E. A.

Bates (John Pelham). **The Treatment of Amebic Dysentery.**—*Jl. Amer. Med. Assoc.* 1916. July 29. Vol. 67. No. 5. pp. 345–347.

The author is of the opinion that a permanent cure of amoebic dysentery ought to be possible in practically all cases, if the ipecac treatment is supplemented by other treatment calculated to aid its amoebicidal action and hasten the healing of the ulcers.

The treatment consists in the administration of bismuth subnitrate in large doses after the course of ipecac or emetine is over. [cf. Deeks. This *Bulletin*, Vol. 4, p. 319.] Enemas of normal saline, two to three quarts at a time, are given from the beginning. The patient must be entirely at rest and a milk diet given in the acute stage. The aim is to carry out this treatment until one is reasonably sure that all the ulcers are healed.

A relatively large portion of the article is theoretical.

E. E. A.

Dale (H. H.). **Treatment of Carriers of Amoebic Dysentery. Note on the Use of the Double Iodide of Emetine and Bismuth.**—*Lancet.* 1916. July 29. pp. 183–184: and *Jl. Roy. Army Med. Corps.* 1916. Aug. Vol. 27. No. 2. pp. 241–244.

Although of great use in amoebic dysentery, emetine does not free every case from the cysts of *E. histolytica*. It is uncertain whether the cyst-producing entamoebae in these chronic cyst carriers are living free in the intestinal contents or are lodged in some partly healed sinus. In favour of the latter supposition is the fact that liver abscess may occur without acute dysentery. In either case the failure of the hypodermic injections of emetine could be explained by the entamoebae being shut off from the tissue fluids. The alleged superior efficacy of ipecacuanha by the mouth in these cases may also be accounted for on this assumption. The author has been giving a drug a trial, which combines the virtues of the emetine and ipecacuanha treatments. This is the double iodide of emetine and bismuth, suggested by Du Mez last year.* It is given by the mouth, and being insoluble in dilute acid it passes the stomach and becomes gradually decomposed with the liberation of emetine and precipitation of bismuth sulphide in the intestine. It has been tried clinically on 10 cases, in all of which cysts had returned after full treatment with hypodermic emetine. They all appeared to be cured except two, one of which relapsed after two full courses of the drug while the other could not tolerate it on account of the vomiting and diarrhoea which it caused. The best way of avoiding these troublesome complications was by administration just after a full meal. A good average daily dose is 3 grains in capsules, representing 1 grain of emetine hydrochloride, and 12 such doses may be given in succession.

E. E. A.

Low (George C.) & Dobell (Clifford). **Three Cases of *Entamœba histolytica* Infection treated with Emetine Bismuth Iodide.**—*Lancet.* 1916. Aug. 19. pp. 319–321.

This is a report on three cases of infection with *E. histolytica*. The first case was one of acute dysentery in which the stools were freed from entamoebae by the new preparation of emetine. It is of course too early to say whether a permanent cure was effected. The second case was a cyst carrier, the original infection dating from seven years back. He had received small doses of emetine under the skin from time to time. The double iodide by the mouth quickly caused the cysts to disappear. A proper course of hypodermic emetine, however, might have had the same result. The third case was also a cyst carrier who responded readily to the drug and has remained free for six weeks.

The administration of this new preparation is accompanied by considerably more disagreeable symptoms than are experienced with the ordinary hypodermic course of emetine. Vomiting is fairly common, while some of the patients are purged.

E. E. A.

* See this *Bulletin*, Vol. 7, p. 446.

Kilgore (A. R.). **Peripheral Neuritis following Emetin Treatment of Amebic Dysentery.**—*Boston Med. & Surg. Jl.* 1916. Sept. 14. Vol. 175. No. 11. pp. 380–382.

Several cases of peripheral neuritis after treatment with emetin have been met with. The trouble usually manifests itself in general muscular pain or weakness especially in the legs, going on sometimes to paresis. Wrist and toe drop are common. The accompanying table shows the amounts of emetin, given in varying doses daily, which have been associated with neuritis. Some of the doses were given intravenously.

	Grains.	
1. Adult	19·5	Severe neuritis.
2. „	6	„
3. „	21·3	mild „
4. „	12·8	moderate „
5. „	about 10	mild „
6. „	15	moderate „
7. Age 8	6	mild „
8. „ 7	5·5	„ „
9. „ 5	4	„ „
10. „ 4	4	„ „

The symptoms disappear gradually on stopping the administration of emetin. Some experiments now in progress suggest that peripheral neuritis may be produced in dogs by emetin.

E. E. A.

Ravaut (Paul) & Krolunitzky (Georges). **L'emploi du novarsénobenzol dans le traitement de la dysenterie amibienne.**—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 510–522.

Not being entirely satisfied with the results of emetine treatment in amoebic dysentery, the authors have been trying the effect of novarsenobensol (salvarsan). An intravenous injection of 0·3–0·45 gm. was given in the acute stage with very beneficial results. The arsenic in the drug had an additional tonic effect, increasing the appetite and making the patient able to tolerate a sustaining diet.

In the case of chronic dysentery where the entamoeba is passed in cystic form the treatment is more prolonged. An intravenous injection of 0·3 gm. was repeated every three days until 10 injections had been given. Although the general condition was much improved the cysts disappeared from not more than one half of the cases. Better results attended the oral administration in gelatine capsules. Two capsules each containing 0·05 gm. were given daily for 10 days. The cysts almost always disappear from the faeces but whether permanently, is not yet certain.

Two complications of amoebic dysentery, namely intestinal haemorrhage and painful enlargement of the liver were successfully treated with novarsenobenzol.

E. E. A.

Risquez (Jesús Rafael). **Una complicación poco frecuente del absceso hepático.** [An Unusual Complication of Liver Abscess.]—*Gaceta Med. de Caracas.* 1916. Aug. 31. Vol 23. No. 16. pp. 121–123

A case of liver abscess which proved fatal by rupture into the inferior vena cava. The patient was a man, aged 52, who entered hospital with all the symptoms of a liver abscess. This was tapped with a trocar and about a litre of pus was drawn off, 100 cc. of a 1 per mille solution of hydrochlorate of emetin being then injected into the cavity. The patient sank rapidly after the operation, and died on the following day. Post-mortem it was found that the abscess cavity occupied the upper and posterior portion of the right lobe of the liver, so that it was brought into contact with the vena cava, which traversed its posterior wall. On being slit up, the vein was found to be discoloured interiorly, with clots adhering to the lining membrane. It communicated with the interior of the abscess by a track formed by one of the supra-hepatic veins, whose walls were softened and the lumen filled with clot. According to Rendu, out of a total of 563 cases of rupture of liver abscess into the different viscera and visceral cavities, rupture into the vena cava only occurred three times.

J. B. N.

Cameron (Donald A.). **A Case of Liver Abscess.**—*Med. Jl. of Australia.* 1916. May 27. Vol 1. 3rd Year. No. 22. pp. 432–434. With 1 chart.

An account of a case of liver abscess in the Australian auxiliary hospital at Harefield. The soldier had spent 13 weeks at Gallipoli but had not had dysentery there ; he had in fact been constipated. There was no history of jaundice. An abscess developed which was opened through the pleural cavity. Two pints of chocolate-coloured pus were evacuated in which amoebae were demonstrated. No attempt to shut off the pleural cavity was made. A large drainage tube was inserted and the patient was given $\frac{1}{2}$ gr. injections of emetine night and morning for about a fortnight. He made a good recovery.

E. E. A.

Eichhorn (Adolph) & Gallagher (Bernard). **Spontaneous Amebic Dysentery in Monkeys.**—*Jl. Infect. Dis.* 1916. Sept. Vol. 19. No. 3. pp. 395–407. With 6 text-figs.

Spontaneous amoebic dysentery in animals is very rare. A case complicated with liver abscess occurred in a badger in the zoological gardens at Cairo and in an orang-outang in Manila. Monkeys have several times been reported to have been infected. A disease called infectious enterohepatitis of turkeys is the only other disease in which an amoeba is known to be the cause.

In the present outbreak 8 monkeys died out of 15 exposed to infection, while of the 9 showing symptoms only one recovered. The actual species of amoeba concerned was not specially investigated. The organisms were numerous in the liver abscesses, but could also be readily found in the faeces, the encysted form being more numerous in the latter.

All the monkeys were of the same species, namely the spider monkey (*Ateles ater*). It is not known for certain which of them introduced the disease, so that the incubation period cannot be defined. With the object of determining the relationship of this disease to the amoebic dysentery of man an attempt was made to infect two cats and two kittens by mixing the faeces of the monkeys with their food, as it is known that these animals can be infected with the *E. histolytica* of man. The cats however did not take the disease and this is looked upon as a point in favour of the amoeba being a species distinct from that which affects man, although too much reliance must not be put upon this because such feeding experiments are by no means invariably successful.

The symptoms shown by the monkeys were first of all marked listlessness. The temperature remained about normal and the appetite was fairly good up to death. Severe diarrhoea set in. The faeces were fluid, yellowish-grey in colour, with a considerable amount of mucus and in the more acute cases also contained blood. Autopsies were performed in eight cases. The caecum and colon were the seats of ulceration which sometimes reached as far as the rectum, but the small intestine was never involved. Liver abscess was met with in the two cases which showed the most extensive intestinal lesions. In one case a single abscess was present, in the other seven. There was no well-defined capsule. As already mentioned active amoebae were demonstrated in the pus.

E. E. A.

Ware (F.). **The Possibility of Amoebic Dysentery in the Dog, and its Treatment with Emetin.**—*Jl. Comp. Path. & Therap.* 1916. June. Vol. 29. Pt. 2. pp. 126–130.

At Ootacamund, a hill station in the Madras Presidency, a pack of foxhounds was kept. They usually enjoyed good health, but for some years dysentery had been a source of trouble. An examination of the faeces revealed the fact that seven of their number were infected with amoebae which bore a striking resemblance to *E. histolytica*. All these hounds were treated with injections of emetin, the dose being ½ grain of the hydrochloride (Burroughs Wellcome and Co.) at first, increased later to one grain which seemed to have a better effect on the dysentery. This is probably the maximum dose for any but a large hound, for it was apparently the cause of vomiting in two small bitches. In addition to the seven animals above mentioned, two others became affected with the disease soon afterwards. A point worth noting is that five out of the nine had been imported from England the same year. Seven of the animals were apparently cured by the treatment; only one had a relapse and this disappeared with further treatment. Of the remaining two one was drafted to another pack, his faeces being normal; the other died.

E. E. A.

Mendel (Joseph). **Recherches sur les amibes dans la pyorrhée alveolaire et les autres stomatopathies.**—*Ann. Inst. Pasteur.* 1916. June. Vol. 30. No. 6. pp. 286–298. With 1 coloured plate.

A number of investigations have been carried out by the author on the amoebae of the mouth, the work being done in the laboratory of

Dr. Salimbeni at the Institut Pasteur. The author describes the morphology of the amoebae observed in both fresh and stained preparations, but no new features are given. With regard to reproduction, though search was made of numerous preparations, clear examples of mitotic division have not been seen. Some forms that might be considered as cysts were observed, but the author reserves his opinion as to whether they were really cysts.

Amoebae were found in 38 out of 40 patients examined. The patients suffered from various maladies, but all had alveolo-dental pyorrhoea. Pyorrhoeal cases in which the secretion was small in quantity yielded more amoebae than those in which there was an abundant secretion. Amoebae were also found in the mouths of persons without pyorrhoea. Twenty-four out of 42 adults and 8 out of 36 children examined were infected. The size and the morphology of the amoebae were the same as in cases of pyorrhoea. In all cases where amoebae were present in large numbers, there was a modification of the gingival exudate, normal leucocytosis being replaced by more or less marked hyperleucocytosis.

Amoebae were also found in a case of chronic suppuration, where the pus had passed between the gum and the root, simulating true pyorrhoea. They were also observed in two soldiers suffering from exceptionally bad gingivo-stomatitis, and in a few other dental maladies.

Attempts at treatment by emetine of amoebae in pyorrhoea was disappointing, as all failed. The author considers that the presence of hyperleucocytosis of the gingival exudate is symptomatic of a certain predisposition to pyorrhoea alveolaris, and that the practice of a rational dental hygiene will do much to reduce the number of amoebae, if not to exclude them.

A. P.

Bacillary Dysentery.

Gabbi (Umberto) & Vanzetti (Ferruccio). **Sulla sindrome, anatomia patologica ed etiologia della dissenteria bacillare osservata nei prigionieri austriaci provenienti della Serbia, e raccolti all'Asinara.** [The Symptoms, Pathological Anatomy and Causative Agent of the Bacillary Dysentery observed in the Austrian Prisoners received from Serbia, and interned at Asinara.]—*Malaria e Malat. d. Paesi Caldi.* 1916. May–June. Vol. 7. No. 3. pp. 151–159.

The survivors of the prisoners taken by the Serbians from the Austrian army under General Potiorek, were sent, by arrangement with the Italian Government, to the Sardinian island of Asinara, because it was impossible to feed them at Nish. A considerable number of them died on the island from symptoms of a dysenteric character, and the present paper gives an account of the post-mortem findings in 13 of the cases. A characteristic ulceration of the colon was present in all, though in varying degrees of severity. The same micro-organism was isolated in every case and presented the form of a Gram-negative, non-motile bacillus, which formed bluish colonies on Drigalski's medium; it would not, however, agglutinate with serum obtained from other cases of dysentery. The serum of seven patients

was tested against standard strains of dysentery bacilli, and gave a positive result in four instances and a negative one in the remaining three, as shown in a table. Three of the positive sera reacted with B. Flexner in a dilution of 1 : 200, and the remaining one with a Shiga in a dilution of 1 : 50.

J. B. N.

Nicolle (M.), Debains (E.) & Loiseau (G.). **Etudes sur le bacille de Shiga.**—*Ann. Inst. Pasteur.* 1916. Aug. Vol. 30. No. 8. pp. 363–382.

This paper in the main does not cover much new ground but the experiments have been carefully carried out. It will suffice to mention the more important points. The animals used were rabbits, guinea-pigs and mice. When *B. dysenteriae* Shiga is inoculated subcutaneously in a lethal dose, the organisms persist in the local lesion until death but do not become disseminated. Introduced into the veins they persist in the liver and sometimes in the bile until death. They could be detected in the blood for 24 hours. They were always absent from the faeces, caecal mucosa, kidneys, urine and spleen. When the dose introduced was sub-lethal, no bacilli could be recovered on killing the animal.

It required about 10 times the amount of bacilli to produce the same result subcutaneously as was obtained by the intravenous method. Heating for half an hour at 55° kills the bacilli, but they remain as toxic as before. Specially autolysed extracts and filtrates were prepared which possessed considerable toxicity.

A strain which was kept on artificial media for 13 years still retained its toxicity unimpaired ; nor was it modified by cultivating for many generations at a relatively high temperature, 42°–47°.

Detailed accounts are given of autopsies on inoculated animals which are hardly of sufficient general interest to record.

As others have found, agglutinating sera furnished by rabbits are more specific than those obtained from horses. The latter always agglutinate *B. dysenteriae* Flexner more than *B. dysenteriae* Shiga, no matter whether living or dead Shiga bacilli, or extracts from the same, were used for the immunisation.

The antiserum prepared protected against living bacilli introduced either subcutaneously or intravenously. The antiserum possesses only moderate agglutinating power, while the agglutinating serum was weak in protective action. To prepare a good antiserum therefore, the extract which the authors employed to make their protective serum should be used for the inoculations, while for the production of an agglutinating serum it is better to use the bacilli themselves.

E. E. A.

Snijders (E. P.). **Over de beteekenis der agglutinatie van dysenteriestammen met menschensera.** [On the Value of Agglutination, with Human Serum, of Dysentery Bacilli.]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1916. Vol. 56. Pt. 2. pp. 105–137. With 1 plate.

The author sets himself in this paper to discuss the precise value of agglutination reactions with dysentery bacilli, for purposes of diagnosis.

He remarks that if we could by this means diagnose latent infections with certainty, the method would be a valuable one, but unfortunately this is not the case in his experience. A certain number of healthy individuals react with all the strains of dysentery bacilli commonly employed for the purpose, to an extent which seriously detracts from the value of the method as a diagnostic agent [see table on p. 120 for the results obtained with 21 Europeans, 19 Javanese, and 20 Chinamen]. Roughly 10 per cent. of the Europeans tested, 15 per cent. of Javanese, and 25 per cent. of the Chinamen reacted positively with B. Shiga-Kruse in a dilution of 1 : 100, and in an even higher proportion with Bacillus Y and B. Y-Flexner in the same strength. His general conclusion is that for diagnostic purposes nothing at present supersedes the microscopic and bacteriological examination of the stools ; and he adds that even very small variations in the preparation of the emulsion, and of the diluting fluids employed, may lead to fallacious results.*

J. B. N.

Kuhn (Philalethes). **Die Bedeutung der Paragglutination für die Diagnose des Typhus und der Ruhr.** [Significance of Para-Agglutination in the Diagnosis of Typhoid Fever and Dysentery.] —*Med. Klinik.* 1916. July 23. Vol. 12. No. 30. pp. 791–792.

Non-pathogenic bacilli of the colon group, which have been isolated from the faeces of patients suffering from typhoid fever or dysentery, are occasionally agglutinated by a specific typhoid or dysentery immune serum. This phenomenon has been called para-agglutination. Even cocci have been known to exhibit it. The susceptibility is lost after repeated subculturing. Such a race can be artificially created by growing *B. coli* on an agar medium containing a small quantity of a broth culture of one of the pathogenic organisms such as typhoid or dysentery. Not only the specific typhoid or dysentery serum but also other agglutinating sera will agglutinate the bacilli to some extent. In addition normal rabbit serum has a definite but much less marked agglutinating action.

It is evident, in view of these facts, that certain errors may arise. It would not be of much practical moment in an acute case if a non-pathogenic bacillus was mistaken for the true cause of the disease, but it would be a grave error to stigmatise a person as a carrier who happened to be passing harmless para-agglutinable bacilli. Another pitfall is that para-agglutinable bacilli may be looked upon as the cause of any given bowel affection whereas the true offender is one of the well-known pathogenic bacteria which has escaped detection. Mistakes of this kind have doubtless occurred in the past and may account for the large and ever-increasing number of different bacilli of the dysentery group, which are supposed to cause the disease. [Since para-agglutinable bacteria retain their power to ferment certain sugars intact, the moral is to supplement the agglutination test with fermentation reactions. If this practice is sedulously carried out no mistakes can arise.] E. E. A.

*[The upper normal limit of agglutination for Shiga here given is considerably higher than most authors have found to obtain in Europe. It may well be that in the Tropics many individuals have passed through a subacute attack of dysentery, which is not forthcoming in their history, but was of sufficient intensity to stimulate the production of a certain amount of agglutinins.—E. E. A.]

Jacobitz. **Ueber Ruhrbacillenagglutination.** [Agglutination of Dysentery Bacilli.]—*Berlin. Klin. Woch.* 1916. June 26. Vol. 53. No. 26. pp. 718–719.

One or two investigators have recently alleged that a prophylactic typhoid and cholera inoculation causes the appearance in the blood of agglutinins against Shiga bacilli. The importance of this is so great that the author has been led to probe the matter further. Forty-nine inoculated persons were tested. The conclusions reached were :—

1. In the blood of people inoculated with typhoid and cholera vaccines, agglutinins against Shiga bacilli do occur in a small number of cases, but they are also found in uninoculated persons.

2. As far as the observations go they do not favour the view that the inoculation with typhoid and cholera bacilli causes the production of agglutinins against *B. dysenteriae* Shiga, but on the other hand an attack of typhoid fever does appear to exert an influence in this direction.

3. The author has not seen an agglutination of Shiga in a higher dilution than 1 : 50 by the serum of persons who have never had dysentery, 20 hours being allowed for the test. This must be taken then as the upper normal limit.

4. Only coarse clumping must be taken as specific.

5. Given a suitable culture, the macroscopic test, coarse clumping, and a dilution above 1 : 50, then a positive agglutination test points to an infection with Shiga's bacillus even in a man inoculated with typhoid and cholera vaccines.

6. These considerations apply in the case of *B. dysenteriae* Flexner-Y with the proviso that the dilution of the serum must be greater than 1 : 100.

E. E. A.

Umnus (O.). **Das Serumagglutination in der Ruhr und Pararuhrdiagnostik.** [Serum Agglutination in the Diagnosis of Dysentery and Paradysentery.]—*Med. Klinik.* 1916. July 2. Vol. 12. No. 27. pp. 723–725.

This paper sets forth the author's views on dysentery agglutination without any experimental evidence to support them. They are summed up in the accompanying table :—

	Widal.	
Diagnosis.	Shiga Dysentery.	Flexner Y-Dysentery.
1. Impossible	up to 1 : 100	up to 1 : 200
2. Probable	above 1 : 100	above 1 : 200
3. Certain	(*a*) above 1 : 400	———
	(*b*) rising or falling titre.	rising or falling titre.

[It is usually thought that a distinct agglutination in a serum dilution of 1 : 50 is sufficient for the diagnosis of a Shiga infection.]

E. E. A.

Hall (I. Walker) & Adam (D. C.). **Differential Leucocyte Counts in Enteric and Dysenteric Convalescents.**—*Lancet.* 1916. Sept. 16. pp. 514–516.

The object of the investigation was to find out whether agglutinins in response to prophylactic inoculation could be distinguished from those appearing in the course of the disease itself by means of a differential leucocyte count. In the first place it was found that a typhoid inoculation made no appreciable difference to the relative proportions of the leucocytes. In the case of typhoid fever there is a persistence of low polynuclear and high mononuclear counts long after the pyrexia is over. This was the case also with paratyphoid A cases from France, but not with those from the Mediterranean area. In the case of paratyphoid B there was not any marked change in the cell counts, but the number of cases examined was not sufficiently large to justify definite conclusions being drawn from the paratyphoids. A few cases of mixed infection with *E. histolytica* and *B. paratyphosus* B showed a decrease in the eosinophils.

Table VI.

Disease.	No. of cases.	Poly-nuclears.	Eosino-philes.	Lympho-cytes.	Transitionals and L. mono-nuclears.	
	Aver-age of	Per cent.	Per cent.	Per cent.	Per cent.	
Paratyphoid A	5	53·5	3·9	35·4	7·2	F.A.
,, B	1	70·5	2·0	23·0	4·5	F.A.
Paratyphoid B + *E. histolytica*	3	68·26	0·93	25·07	5·74	
Paratyphoid A + *E. coli*	5	66·12	2·8	26·5	4·58	
Paratyphoid B + *E. coli*	5	70·8	1·8	23·8	3·6	
Paratyphoid + *Lamblia intestinalis* ..	5	67·7	2·8	25·0	4·5	
Paratyphoid A	17	65·55	2·97	27·79	3·69	M.A.
,, B	33	69·76	2·78	23·21	4·25	M.A.
Typhoid	6	49·3	2·16	40·64	7·9	
Typhoid + *E. histolytica*	1	65·7	4·8	27·0	2·5	

M.A. = Mediterranean area.
F.A. = French area.

E. E. A.

Hehewerth (F. H.). **Ueber Dysenteriebacillen und ihre Einteilung in Gruppen.** [Grouping of the Various Dysentery Bacilli.]—*Cent. f. Bakt.* 1. Abt. Orig. 1916. May 9. Vol. 78. No. 1. pp. 3–15.

The article begins with a good historical survey of the discovery of the different dysentery bacilli. A good deal of confusion has hitherto been introduced into this subject by workers relying on sugar reactions alone for differentiating the different species; or again by neglecting these and basing a classification solely on agglutination reactions. It was the author's aim to attempt to correlate these two factors.

A small epidemic of dysentery occurred in an internment camp in Holland. Twenty-six non-motile Gram-negative bacilli obtained from the stools of patients were examined. Their sugar fermentation reactions are given in the following table :—

TABLE I.

Strain.	Mannite.			Maltose.			Saccharose.		
	Very short time after isolation.	2–2½ months after isolation.	3½–4 months after isolation.	Very short time after isolation.	2–2½ months after isolation.	3½–4 months after isolation.	Very short time after isolation.	2–2½ months after isolation.	3½–4 months after isolation.
74a	+	+	—	+	—	—	+	—	—
74b	+	+	+	—	—	—	—	—	—
74c	+	+	+	+	—	—	+	—	—
77a	+	+	+	—	—	+	—	—	—
77b	+	+	+	+	+	+	—	—	—
77c	+	+	+	+	+	+	—	—	—
78a	+	+	+	—	—	—	—	—	—
78b	+	+	+	—	+	+	—	—	—
78c	+	+	+	—	—	—	+	—	—
78d	+	+	+	+	—	—	—	—	—
78e	+	+	+	—	—	—	—	—	—
21a	+	+	+	+	—	—	—	—	—
21b	+	+	+	—	—	—	—	—	—
22a	+	+	+	+	—	—	—	—	—
22b	+	+	+	+	—	—	—	—	—
23a	+	+	+	—	—	—	—	—	—
23b	+	+	+	+	—	—	—	—	—
23c	+	+	+	—	—	—	—	—	—
23d	+	+	+	—	—	—	—	—	—
24a	+	+	+	—	—	—	—	—	—
24b	+	+	+	+	—	—	—	—	—
25a	+	+	+	—	+	+	—	—	—
25b	+	+	+	—	—	—	—	—	—
59	+	+	+	—	—	—	—	—	—
88a	+	+	+	—	+	+	—	—	—
88b	+	+	+	—	+	+	—	—	—

It will be seen that they all ferment mannite and they are therefore not *B. dysenteriae* Shiga ; but the instability of these reactions as regards maltose and saccharose is manifest from an examination of the five strains numbered 78, all of which were isolated from the same patient. Yet it is just upon the reactions of these sugars that the classification into Flexner, Y, and Strong groups is based.

The agglutination reactions were now investigated using sera prepared with two of their number and employing the Castellani absorption method. It was found that these did not run at all parallel with the results obtained with sugars. The author's final judgment is that at present we are unable to further classify the non-toxic dysentery bacilli since from the same epidemic strains can be isolated which are

serologically not related. The practical outcome of this is that an antidysentery serum should be prepared with as many strains as possible which, as regards agglutination, are as widely separated as possible.

E. E. A.

Remlinger (P.). **Sur un nouveau bacille dysentérique atypique.**—*C. R. Soc. Biol.* 1916. June 17. Vol. 79. No. 12. pp. 576–578.

A variant of *B. dysenteriae* Shiga was isolated from a case in Argonne. It has the same fermentation reactions, but it is slightly motile. It was not agglutinated by any of the usual agglutinating sera, nor even by the patient's. Innoculation into rabbits produced a high titre agglutinating serum (1 in 3,000), which also agglutinated Shiga at a 1 in 100 dilution. [The evidence that it is pathogenic in man is very slender.]

E. E. A.

Bonnel (F.), Joltrain (E.) & Tauflieb (R.). **A propos d'une petite épidémie de dysenterie bacillaire observée dans la zone des armées pendant l'été 1915.**—*Bull. et Mém. Soc. Méd. des Hôpit. de Paris.* 1916. Apr. 20. 3 ser. Vol. 32. No. 13–14. pp. 589–599. With 3 figs.

An account of a small epidemic of dysentery comprising 278 cases, with no deaths. It seems to have been caused by a bacillus belonging to the mannite fermenting group of organisms (Flexner-Y), although distinct from the well known types.

E. E. A.

Sutherland (P. L.). **Bacillary Dysentery (Shiga) contracted in England.**—*Brit. Med. Jl.* 1916. July 29. p. 142.

A woman of 50 contracted dysentery six days after her son's return home. The latter had had the disease at the Dardanelles and it was still present in a subacute form. *B. dysenteriae* Shiga was isolated from the faeces of both these patients.

E. E. A.

Cahn (A.). **Ueber die Folgen geringfügiger Infekte von Ruhr und Typhus und über Ruhrnachkrankheiten.**—*Berlin. Klin. Woch.* 1916. June 12. Vol. 53. No. 24. pp. 642–646.

This is a reproduction of a lecture delivered on the above subject. The author's contention is that many ill-defined complaints such as "rheumatic" pains, lassitude, neuritis, myalgia, etc., can be attributed to a previous infection with dysentery or typhoidal disease. The cases investigated included patients who had passed through an attack of dysentery or typhoidal disease; those complaining of joint pains, etc.; others who gave no history of any of these diseases and were either apparently healthy or suffering from something quite different. The demonstration of agglutinins in the blood was naturally the only way of attacking the problem. Each serum was tested against *B. dysenteriae* Y and Shiga, *B. typhosus*, *B. paratyphosus* A and B. Of 157 cases tested 14 gave no agglutinations; 11, who were either

well or suffering from other diseases had a titre greater than 1 : 100 for Y or Shiga; 14, who complained of weakness, rheumatic pains, myalgia, etc., agglutinated dysentery bacilli alone.

Amongst other manifestations to be looked upon as caused by dysentery bacilli was neuritis, chiefly of the sciatic and trigeminal nerves. Two cases of paralysis of accommodation were observed which could only be attributed to dysentery. Some cases of arthritis had the additional complication of bladder trouble. Stomatitis was fairly common and dyspepsia was also observed.

This is not the first time that dysentery has been looked upon as responsible for these minor ailments. It is well known that a toxin is formed by the bacilli of Shiga type which in laboratory animals is very neurotropic causing extensive paralysis. We should expect this toxin also to be elaborated in man and occasionally cause lesions of a like nature.

E. E. A.

Rose (Carl Wienand). **Ruhrnachkrankheiten und deren Behandlung mit Antidysenteriserum.** [Post-dysenteric Ailments and their Treatment with Anti-dysentery Serum.]—*Berlin. Klin. Woch.* 1916. June 12. Vol. 53. No. 24. pp. 646–648.

Certain authors have lately attempted to discredit the value of dysentery agglutination in soldiers on the plea that a prophylactic typhoid inoculation induces group agglutination of dysentery bacilli. Doubting the truth of this the author has tested the blood of 80 soldiers, who were in hospital for some different complaint, against Y and Shiga bacilli. They were specially chosen to avoid all intestinal infections and they had received typhoid inoculation within 1–3 months. None of them agglutinated the organisms in question.

The middle portion of the paper is taken up with an enumeration of the various postdysenteric ailments met with, after which there is an account of the benefits accruing from the use of anti-dysentery serum. Among the affections which quickly disappeared under this treatment were "rheumatic" joints, myalgia, neuralgia, neuritis, paralysis of accommodation, conjunctivitis, stomatitis, local anasarca, anaemia, dyspepsia due to decrease of acidity, and weakened heart. Two or three injections of polyvalent antidysentery serum at intervals of a day or two were usually sufficient. Serum rashes can be avoided by giving calcium chloride before the injection or by following Friedberger's advice of injecting small quantities of the antiserum at first, the remainder being given after a lapse of some hours.

E. E. A.

Usener (W.). **Zur Klinik der Bacillenruhr und ihrer Behandlung mit Atropin.** [The Clinical Aspect of Bacillary Dysentery and its Treatment with Atropin.]—*Berlin. Klin. Woch.* 1916. July 17. Vol. 53. No. 29. pp. 799–801.

The painful colic and tenesmus, which is such a marked feature of bacillary dysentery, together with the frequent completely liquid stools, are not adequately accounted for by the pathological findings. Their real cause is probably a toxic irritation of the sacral portion of the vagus.

A number of autopsies were made on dysentery cases in more than half of which the ileum was affected. A point of still greater interest was the finding of formed faeces, typical of those present in the large bowel, in the lower and even in the middle segments of the ileum. Sometimes the faeces were in a condition of fermentation, yellowish in colour, frothy, with little mucus; at other times they had undergone decomposition, were dark-brown, soapy, in the form of small pellets or resembling a pencil. The explanation of this is that irritation of the vagus can bring about the same spastic conditions in the small intestine as obtain in the large, giving rise to the retention of the effete products of digestion and allowing of the same kind of bacterial action. The stomach disturbance which is present in a certain number of the cases of dysentery would also be accounted for by a toxic affection of the vagus. These considerations suggested the use of atropine. The results were encouraging, as within 12–18 hours formed faeces appeared in the stools and within 18–24 hours the blood and slime were either gone or markedly diminished in quantity. The drug was injected subcutaneously in a dose of 0·5 mgm. two or three times daily at intervals of two hours. In order to avoid the effects of a possible idiosyncrasy 0·01 mgm. morphine was given in conjunction with the second dose. An increase of this dose is probably not necessary.

E. E. A.

Flexner (Simon). **The Rapid Production of Antidysenteric and Antimeningococcic Sera.**—*Jl. State Med.* 1916. June. Vol. 24. No. 6. pp. 161–171; July. No. 7. pp. 193–206. With 5 charts.

Owing to the sudden demand for anti-sera since the beginning of the war the Rockefeller Institute, of which the author is the director, resumed the manufacture of antidysentery and antimeningococcic sera. The old established method of preparing antidysenteric serum was by a series of subcutaneous injections into the horse. In from 9 to 12 months a high titre serum was obtained. The exigencies of the moment however have demanded a more rapid method. By means of repeated intravenous injections for short periods with intervals of rest it has been found possible to produce a serum of high protective value in about 10 weeks. Several varieties of dysentery bacilli are injected successively, both Shiga and Flexner types. Details of the process are given, which are of interest only to those engaged in the production of such sera.

The second portion of the paper deals with antimeningococcic serum.

E. E. A.

Loewy (Otto). **Dysenterieschutzimpfung.** [Inoculation against Dysentery.]—*Wien. Klin. Woch.* 1916. May 18. Vol. 29. No. 20. pp. 617–619.

Certain authors have found that the addition of acid to the toxin of *B. dysenteriae* Shiga renders it innocuous but does not destroy it, since the subsequent addition of alkali restores its activity. Loewy has experimented on similar lines using suspensions of agar cultures of Shiga bacilli. Neutral and acid suspensions produced considerably less local reaction than alkaline ones, while a greater proportion of the

animals survived. Furthermore the amount of agglutinins and complement-binding antibodies formed in the animal's serum was independent of the reaction of the vaccine. The animals used were rabbits, guinea-pigs and goats. They did not receive a sufficient number of injections to induce much immunity. Some of the rabbits which were tested were unable to withstand a double lethal dose of toxin.

E. E. A.

Malaria e Malattie dei Paesi Caldi. 1916. May–June. Vol. 7. No. 3. pp. 204–218. With a map.—**Dissenteria bacillare epidemica. Pubblicazioni monografiche delle malattie degli eserciti in guerra della Scuola delle malattie esotiche annessa alla R. Clinica Medica di Roma.** [Gabbi (U.) & Giugni (Fr.).]

This is another of the series of monographs, of a succinct and practical type, which are now appearing in the pages of the above periodical, for the benefit of military surgeons during the present war. The subject of bacillary dysentery is handled in this one in a very masterly manner.

J. B. N.

Flagellate Dysentery.

Fantham (H. B.) & Porter (Annie). **The Pathogenicity of *Giardia* (*Lamblia*) *intestinalis* to Men and to Experimental Animals.**—*Brit. Med. Jl.* 1916. July 29. pp. 139–141.

The authors have detected 187 cases of pure lambliasis among 1,305 soldiers invalided from Gallipoli, as well as among soldiers from the Western Front. They found that "in both human and animal lambliasis . . . erosion and distortion of the intestinal epithelial cells occurred, owing to the direct suctorial action of the flagellate Lamblia."

Human cases.—Some of the evidence in this section has been already published and summarised in this *Bulletin* [Vol. 8, p. 131]. Two strains were under observation, one from Flanders, the other from Gallipoli; the former was the more virulent. They note that lambliasis is well known in Italy and also occurs in Russia and Germany; it is not confined to the tropics, nor is its virulence reduced in cold countries, as has been supposed.

Animal experiments.—Kittens and mice were used. Strict precautions were taken to ensure the animals being free from Lamblia infection, since it occurs naturally in mice. They were fed on food contaminated with faeces or material containing lamblial cysts. Details of 17 experiments are given. Infection was obtained in all but four instances, the chief symptoms being diarrhoea and emaciation. The infected kittens died in from 6 to 53 days. Of the mice which became infected two recovered and the others died in from 7 to 76 days. Accounts of the post-mortems are given. Erosion of mucous membrane and engorgement of the blood vessels of stomach, intestines and mesentery were noted, and in two instances enlarged spleen and duodenal ulcers.

The conclusions are as follows:—

"1. *Giardia* (*Lamblia*) *intestinalis* is pathogenic to man and is capable of producing diarrhoea, which may be persistent or recurrent.

" 2. The virulence of the parasite varies, and lambliasis occurs in tropical and non-tropical countries. The Lamblia cysts can remain infective for some time.

" 3. Lambliasis occurs in rodents, especially rats and mice, and can be of human origin. The influence of rats and mice in the spread of lambliasis has been noted recently by Noc and by Mathis. Lambliasis may also be produced in cats. Lambliasis may be conveyed to man from these mammals.

" 4. As a result, rodents may be reservoirs of lambliasis, and on the western front this should be remembered, as we have already published."

A. G. B.

Smith (A. Malins) & Matthews (J. R.). **Lamblia Infections in Men who have never been out of England.**—*Brit. Med. Jl.* 1916. Sept. 16. p. 389.

The present note records the cases of two soldiers who, though they had never been out of England, had an infection of *Lamblia* [more correctly, *Giardia*] *intestinalis*. The stools of the men were examined in the course of routine at the Liverpool School of Tropical Medicine. The first case was a man suffering from gastric ulcer. Lamblia cysts were found in his stool on the one occasion that a specimen was examined. The second case was that of a man who, after six weeks' training, was sent to hospital for treatment of diarrhoea. He had suffered from diarrhoea at irregular intervals for twelve years. The patient is still under observation. A third case of a sailor who, apart from two days spent in Holland, had not left England, yet had Lamblia in his stool on the two occasions that it was examined, is also mentioned. He was suffering from cardiac and gastric trouble when sent to hospital.

The first two patients contracted the parasites in England. The sailor possibly became infected here. The authors can offer no evidence as to time or place of infection, nor as to the possible or probable connection of the Lamblia with the diarrhoea produced. They state that it is almost impossible now and shortly will become impossible to offer evidence whether Lamblia is indigenous in England or not, owing to the presence of returned soldiers who are carriers of Lamblia.

[While in these two cases the parasites were acquired in England, there is no evidence that the parasites were of English origin, or that they might not have been acquired from some individual infected abroad with whom the men concerned had associated. It gives no evidence whether Lamblia is indigenous in England or not.]

A. P.

Mixed and Unclassed Dysentery.

Krause (Paul). **Vorkommen von *Balantidium coli* und *Trichomonas intestinalis* bei einem Darmkranken mit choleraähnlichen Erscheinungen.**—*München. Med. Woch.* 1916. July 18. Vol. 63. No. 29. pp. 1058–1060.

The paper contains an account of a patient, whose faeces contained Balantidia and Trichomonads, who suffered from acute diarrhoea so that he was suspected of having cholera, but who was free from

dysenteric bacteria and negative also for typhoid and cholera. The apparent association of Balantidia with disease-producing capacities is set forth at length.

The patient was a Landstürm recruit, aged 27, who, at the end of July, 1915, was for six weeks in Galicia and reached Ossowiecz. In August he suffered from diarrhoea, the stools containing some blood at the end of the illness. Several others in the same company were similarly afflicted. In the autumn, the man was sent to the Western Front, where he again suffered from diarrhoea, stools mixed with blood and mucus being passed seven times a day. Early in November, he became worse and cholera was suspected. The stools were somewhat like rice-water stools, flocculent, and contained leucocytes, mucous fatty drops, few bacteria, but numerous protozoa, which were identified as *Balantidium coli*. In later stools, *Trichomonas intestinalis* was found in smaller numbers.

Details of the case are given somewhat fully. The treatment was by salt infusions. The patient made a good recovery, and eventually rejoined the forces in the field. The Protozoa had disappeared when he became convalescent. Bacteriological examinations were negative for pathogenic bacteria.

The author gives a short account of all the previous findings of Balantidium species in stools that were of abnormal character, such as cholera and typhoid stools. Three species of Balantidium are known to be present in the human intestine at times, and the differences are put in the form of a table. A similar discussion on the association of Trichomonas with dysenteriform symptoms is also given, but no conclusion appears to have been reached.

A. P.

Tribondeau (L.) & Fichet (M.). **Note sur les dysenteries des Dardanelles.** — *Ann. Inst. Pasteur.* 1916. July. Vol. 30. No. 7. pp. 357–362.

This is an important article inasmuch as it adds Morgan's bacillus to the ever increasing number of organisms which can cause dysentery. Many cases of the disease give negative bacteriological findings, and it may well be that some of them are due to this organism. It was first isolated by Morgan in England from an epidemic of infantile diarrhoea. Until recently it has not been associated with diarrhoea in adults.

The present investigation deals with 217 cases of dysentery at Toulon, invalided from the Dardanelles. Many of them were on the high road to recovery, which probably accounts for the large number of cases (169) in which neither amoebae nor pathogenic bacilli were found. Of the 48 positive findings :—

10 were *E. histolytica*.
23 „ *B. dysenteriae* Shiga.
2 „ „ „ Y.
13 „ Morgan's bacillus.

The interest centres round the last group. There is every reason to believe that these bacilli were the cause of the dysentery. The patients passed blood and slime, while Morgan's bacillus was present in large numbers, to the exclusion of the usual dysenteric germs. In all these cases the course of the disease has been severe and prolonged, with frequent relapses, ending in death in two instances. The only anomaly was that the patient's sera did not agglutinate the bacillus, nor were Shiga and Flexner bacilli agglutinated. The types of Morgan's bacillus isolated were the following :—

Type.	Lactose.	Glucose.	Mannite.	Maltose.	Saccharose.	No. of cases.
I. (Morgan's No. 1 of English authors)	0	+	0	0	0	7
II.	0	+	+	+	+	1
III. A.	0	+	0	+	+	2
B.	0	+	0	+	+	3

After prolonged cultivation on artificial media the last two types lost the power to ferment all the sugars but glucose. They are all motile, produce indol rapidly, and blacken an agar medium containing lead subacetate. Morgan's bacillus was never found in the patient's blood. It was shown to be pathogenic for laboratory animals. An agglutinating and curative serum was easily produced.

E. E. A.

Gunson (E. B.). **Cardiac Symptoms following Dysentery among Soldiers.**—*Lancet.* 1916. July 22. pp. 146–147.

During October 1915, 65 cases of dysentery were admitted to the 19th General Hospital, Alexandria, from Gallipoli. No examinations of the faeces were made, but clinically about 75 per cent. of the cases were amoebic. A number of the patients exhibited circulatory disturbances. There were three fatal cases. The pulse became extremely feeble, the extremities cold and clammy, while cardiac dilatation supervened in the terminal stages associated with extreme cyanosis. Of the patients who recovered 17 per cent. presented cardiac symptoms. Dyspnoea, palpitation, precordial pain, vertigo and exhaustion were the chief symptoms. The exhaustion was very marked in the severe cases and was greater than the muscular atrophy and weakness seemed to warrant, but no evidence of organic disease of the nervous system was present. The incidence of cardiac symptoms in this epidemic was high because most of the men remained on duty in the trenches until completely exhausted. The only drug which was found to be beneficial for the extreme cardiac weakness was adrenalin. It was administered subcutaneously every four hours in doses of 5 to 10 minims.

E. E. A.

Hall (I. Walker), Adam (D. C.) & Savage (R. E.). **Convalescent Paratyphoidal and Dysenteric Cases considered from the Preventive Standpoint.**—*Brit. Med. Jl.* 1916. Aug. 5. pp. 174–177.

The cases were drawn from the Mediterranean area, during the period September 1915 to February 1916. The distribution of the dysenteric amoebae is given in the table below :—

	E. histolytica present.
Dysentery cases	9·68 per cent. (605 cases).
Paratyphoidal cases	10·06 per cent. (581 cases).
Wounds, trench fever, etc. ..	1 case .. .. (5 cases).
Depot paratyphoids	5 cases, 21·7 per cent. (23 cases).

As regards the disappearance of *E. histolytica* from the faeces in cases under treatment, it was found that the average time required before three consecutive negatives could be obtained was about 23 days.

E. E. A.

Sick (K.). **Ueber Veränderungen am Magendarmkanal im Gefolge von Typhus und Ruhr.** [Changes in the Digestive Tract following Typhoid Fever and Dysentery.]—*München. Med. Woch.* 1916. Aug. 15. Vol. 63. No. 33. pp. 1205–1207. With 1 text fig.

In the convalescent stage of both typhoid fever and dysentery some of the patients developed a marked distension of the abdomen. The cause of this appears to be a toxic action on the splanchnic division of the vagus nerve, which is supported by the fact that these cases usually exhibit an increased pulse-rate due to removal of the inhibiting action of the vagus. Decreased acidity of the gastric juice was commonly present in the dysentery cases. This late complication delayed complete recovery for 2–3 months.

E. E. A.

von Korczynski (L. R.). **Bacilläre Ruhr und akuter hämorrhagischer Dickdarmkatarrh.** [Bacillary Dysentery and Acute Haemorrhagic Colitis.].—*Med. Klinik.* 1916. July 23. Vol. 12. No. 30. pp. 801–803.

This is the sequel to a previous paper and gives an account of the author's experience of bacillary dysentery at Sarajevo. In cases caused by Shiga's bacillus anti-dysentery serum was found to be of great value but should be employed in large doses—100 cc. or more.

A number of cases of acute haemorrhagic colitis, which were not dysentery, were classed together, no pathogenic bacteria having been isolated from them. They occurred for the most part during the months when typhoidal fevers and dysentery are most prevalent. Exposure to wet and cold, and indiscretions in diet are looked upon as the chief causes.

E. E. A.

Ziemann (H.). **Zur medikamentösen Behandlung der Ruhr (durch Kombination von Bismutum subnitric. mit Karlsbader Salz).** [Drug Treatment of Dysentery, by a Combination of Bismuth Subnitrate and Carlsbad Salts.]—*München. Med. Woch.* 1916. Aug. 8. Vol. 63. No. 32. pp. 1170–1171.

After disposing of the various drugs in vogue for the treatment of bacillary dysentery, with the exception of anti-dysentery serum, as being more or less unsuccessful, Ziemann outlines his own special method of treatment. It is extremely effective not only in bacillary dysentery but also in the amoebic variety, and again in dysenteric diarrhoeas where a pathogenic bacterium cannot be found, and even in paratyphoid fever running a dysentery-like course. The essence of the treatment is the combination of Bismuth subnitrate with Carlsbad salts. The patient has a hot water bottle applied to his abdomen. A dessertspoonful of castor oil is administered immediately, and if this produces a copious motion, a teaspoonful of Carlsbad salts in 300 cc. (half a pint) of warm water is given four hours later. If this solution cannot be tolerated, the salt may be taken in cachets and the water drunk afterwards. Morning and evening of the next and subsequent days the patient takes a teaspoonful of Carlsbad salts in warm water, in conjunction with a 5 grain tablet of bismuth subnitrate 6 to 10 times a day. In the vast majority of cases the blood and slime disappear from the stools on the 2nd or, latest, on the 3rd day. If, contrary to what one expects, the blood and slime appear again in the motions the bismuth is withheld for a day or two. A tendency to constipation is combated by diminishing the bismuth and increasing the Carlsbad salts, while diarrhoea requires the converse modification. The ideal to be aimed at is to obtain three liquid stools a day. In the rare cases in which relapses occur the whole treatment is started afresh. The full treatment should be continued for at least 5–7 days after the stools have become normal and then gradually reduced. E. E. A.

Reed (Alfred C.). **The Use of Emetin.**—*Boston Med. & Surg. Jl.* 1916. Sept. 14. Vol. 175. No. 11. pp. 375–380.

This paper goes over much the same ground as those of Levy and Rowntree and of Balfour and Pyman [see this *Bulletin*, Vol. 8, p. 218–9]. The author discusses the history, pharmacology, toxicology and uses of the drug. He notes that "practically all of the emetin used and even now available is impure and has been shown to have a dangerous variation in activity and toxicity. . . . Pure emetin . . . so far has not been thoroughly studied in either the clinic or the laboratory." Hesse, who has devised a method of isolation, attributes the chief danger in emetin to contamination with the strongly toxic cephaelin. The author refers to the profoundly irritative local action, the depressant action on the heart and circulation after repeated small hypodermic doses in animals, death in emetin poisoning occurring from cardiac failure, and the irritating effect on the gastro-intestinal tract. The consensus of opinion, it is stated, is to the effect that emetin does act as an emetic, but it appears that this effect follows only administration by mouth. The symptoms above named occur in poisoning, in which there is "often a condition scarcely to be distinguished from acute beriberi."

In the treatment of amoebic dysentery "not infrequently the diarrhoea from emetin is confused with the amoebic diarrhoea and the drug is continued or increased to a dangerous degree." Cases of mild poisoning seen in China are mentioned. Reference is made to LEVY and ROWNTREE's 20 tabulated cases, and especially the cases of peripheral neuritis. It is recognised that "a beriberi or pseudo-beriberic condition may arise in dysentery [both amoebic and bacillary] and be credited to emetin." On the question of dosage the author's views are in accord with those of BALFOUR and LOW. Finally the uses of the drug in amoebic dysentery, tropical abscess, pyorrhoea, as an expectorant and for haemorrhage are discussed. The value of the two last uses is doubted.

A. G. B.

BERIBERI.

Ashburn (P. M.). **Beriberi in Panama.**—*Proc. Med. Assoc. Isthmian Canal Zone for the Half Year Oct. 1914 to Mar. 1915.* [1916.] Vol. 7. Pt. 2. pp. 101–129. With 6 charts.

A disease clinically indistinguishable from beriberi has been frequently reported to be more or less commonly present in the Panama area. From the medical returns the author has compiled a chart showing that from 1887 there are marked fluctuations in the incidence of the disease, and it appears that the Canal work was commenced during one of the epidemic periods and the disappearance of the cases from the Ancon hospital coincided with the subsidence of the epidemic. The author states that he is firmly convinced by the observations of Braddon, Fraser, Stanton and others that beriberi in the Orient is a deficiency disease dependent on an insufficient supply of vitamines, and that their absence in the food is as important a fact for diagnosis, as is the presence of alcohol or lead in the respective forms of neuritis produced by them. In the Canal Zone district the food supply generally appeared to be good and included beans and other anti-neuritic substances; a number of dietary tables are given to demonstrate this. The disease is seen to have a marked periodicity with its maximum towards the end of the wet season, and it was often associated with malaria, rarely affecting children and old people. He made a special study of an epidemic at the National Institute or Government Academy, where the hygiene was generally excellent, the food abundant, fresh, and varied, and no evidence of a deficiency of anti-neuritic food was present. He states that up to the present no sufficient clinical or laboratory investigation of the beriberi-like disease has been carried out in the Canal Zone, and suggests that when this is done particular attention should be paid to the blood, post-mortem pathology, incidence of the disease in children, dietary, and the prevalence of insects and mosquitoes. It is noted that there were no cases recorded in the leper hospital, and that one cause of the rapid decrease in the number of cases treated at the Ancon hospital was the fact that after 1906 most of the charity subjects, who provided the greater number of the beriberi cases, were sent to the Santo Tomas hospital.

As a possible explanation of the occurrence of these forms of beriberi in apparently well-fed individuals the author brings forward the theory of Braddon and Cooper, who hold that the quantity of the vitamine-containing substance must bear a definite proportion to the carbohydrates ingested; when this necessary balance is not maintained beriberi results. Thus a dietary with an apparent sufficiency of vitamine-containing food may by the addition of large quantities of carbohydrates become dangerous; therefore, as the exact proportion required is unknown, it is necessary to have the anti-neuritic foods as high as possible.

P. W. Bassett-Smith.

McDonald (W. M.). **The Beriberi Puzzle: A Suggested Solution.**— *Jl. Trop. Med. & Hyg.* 1916. Aug. 1. Vol. 19. No. 15. pp. 177–178.

The author, "as an observer not of the disease itself but of the circumstances of its occurrence in different parts of the world," is apparently a firm believer in the infectiousness of beriberi, and considers that the discovery of Fraser and Stanton instead of clearing up the puzzle only makes it more complicated. He, like many others, limits his horizon to the rice theory, which as we know is only part of a fundamental fact in certain areas, whereas the supply of rice or any other staple diet has to be considered together with many secondary factors before drawing conclusions about any outbreak. He cites five instances, which without further information discredit the view that the disease is due to "deficiency," and argues that the age and sex incidence are also against this. He also holds the view that experimental cases in men and animals in which errors in diet have been proved to produce the disease are not true beriberi but a form of peripheral neuritis like beriberi. In his opinion beriberi is entirely dependent on overcrowding and unhygienic sleeping accommodation, it is probably a protozoal disease conveyed by bed bugs or body lice [a theory which has many times been disproved] and the prophylactic measures necessary are, improvements in housing and sleeping accommodation where large numbers of men live together.

P. W. B-S.

Fleming (Robert A.) & Gibson (H. J. C.). **Three Cases of Beriberi.**— *Edinburgh Med. Jl.* 1916. July. New Ser. Vol. 17. No. 1. pp. 27–33.

The authors describe three cases of beriberi treated at the Royal Infirmary, Edinburgh; all three were firemen, two from the steamship "Araguez," and one from the steamship "Perana," and all had started from Rio. The symptoms were of moderate severity with marked signs of peripheral neuritis and some cardiac dilatation. They all improved under treatment in which a varied and good dietary played an important part, though one of them developed pulmonary tuberculosis. It is stated that the men were poorly clothed and suffered severely from the cold on arrival. One ship was visited and the conditions of the forecastle were exactly those so often described by Sir Patrick Manson as a perfect incubator for the growth of any germs.

There was no history of previous epidemics of beriberi in either ship. Out of forty men in one ship there were five definite cases and two others with mild symptoms; the ship carried no medical officer. The food is stated to have been:—

6.30 a.m.—Coffee, bread and butter.

10.0 a.m.—Stewed meat, rice, beans, farina and coffee.

4.0 p.m.—The same kind of dietary.

7.0 p.m.—Tea and bread and butter. The rice that was used was not of the highly polished kind.

It would seem therefore that vitamine containing foods were abundant [but nothing is stated as to the cooking, which might easily destroy the protective qualities]. The beans were examined and were found to be *Phaseolus vulgaris*. During the voyage no complaints with regard to the food were made by the crew. The authors consider that the cold weather might have precipitated the attacks, and they do not think the facts point to a "deficiency" of any element in the diet but rather to a toxin of some unknown origin as being the cause of the outbreak.

P. W. B-S.

Gesteira (Martagão). **Um caso de beriberi infantil.** [A Case of Infantile Beriberi.]—*Brazil Medico*. 1916. July 1. Vol. 30. No. 27. pp. 209–212. With 1 fig.

A case of beriberi in a child aged 2½ years, admitted into hospital with a history of having, 12 days before, been taken with pains in the chest and legs, oedema of the lower limbs and difficulty in walking. In addition there was considerable blepharoptosis, especially of the left eye, with marked pupillar dilatation. Examination of the cardiac region showed that the pains in the chest were due to pericardial effusion. An illustration of the child is given showing the above general features. A diagnosis was made of beriberi. Except that the child recovered, nothing is said of the progress of the case, or of the treatment adopted, or of the probable cause of the condition.

J. B. Nias.

Matsuoka (Yeisaku). **On the Pathological Anatomy of the Lungs in Beriberi (Kakke).**—*Jl. Path. & Bact.* 1915. Oct. Vol. 20. No. 2. pp. 191–213.

A considerable amount of work has been done to clear up the pathology of beriberi but the greater part has been devoted to the changes in the nervous system. The Japanese school hold the hypothesis that neuritis and contraction of the blood vessels are essential factors. Yamagiva has described the pathological findings in the lungs, but certain points bearing on the causes of the dilatation and hypertrophy of the right heart and the changes in the volume capacity of the lungs have not yet been satisfactorily explained. In the present work the author has attempted to clear up certain of these points. Five cases are very fully described and the findings discussed, the anatomical histological conditions found being compared with numerous control cases. He points out that the upper portion of the anterior border of the right lower lobe is a particularly favourable selective area and that collapse in this position alone is of considerable importance, as excepting for emphysema this part is very rarely the seat of any other disease condition. He found that the oedema of beriberi lungs is always associated with congestion; this is not entirely due to the agony period but may occur before through the feeble action of the left ventricle and is followed by the hypertrophy of the right. This oedema is always diffused while that produced during the agony period is localised and hypostatic. The volume of beriberi lungs is generally

equally diminished throughout; they show areas of collapse but though the amount of air is diminished the blood supply is increased in them. Emphysema is rarely found except in localised patches, together with areas of collapse, the margins of the lungs remaining sharp. He states that the diminished capacity of the lungs is not due to the slight increased height of the diaphragm due to paresis in beriberi, as this would only affect the lower lobes; hydrothorax however plays a very important part, occurring in 80 per cent. of his cases, but probably many other factors come into play to cause the diffuse uniform diminution in volume. In his investigations he found splenisation usually in the posterior and lower portions; in 66 per cent. in the left lung and 50 per cent. in the right.

Whether as suggested by Yamagiva there is an ante-mortem contraction of the small arteries of the lungs causing a dilatation hypertrophy of the right heart is doubtful; this view is opposed by Ogata. It appears that the dilatation hypertrophy of the typical beriberi heart is due to the collapse of the lung associated with the congestion oedema arising from the early enfeeblement of the left ventricle and, as the resistance in the pulmonary circulation becomes more marked, the hypertrophy of the right heart increases to overcome this and is followed by dilatation.

P. W. B-S.

Sarasi Lal Sarkar. **Outbreaks of Epidemic Dropsy in Mofussil.**—*Indian Med. Gaz.* 1915. Oct. Vol. 50. No. 10. pp. 368–394; Nov. No. 11. pp. 417–419.

This is an account of various small outbreaks of epidemic dropsy occurring in India, at Nator in 1906, Dhanbaid, Behar in 1909, and at Muragacha in 1914. At Nator all the cases were in the household of a rich merchant; 19 persons were affected and there were four deaths, three women and one man. The onset is stated to have been sudden. Most of the family after the evening meal were attacked with vomiting and diarrhoea which lasted three or four days; the later symptoms were a low type of fever, a more or less general oedema with diarrhoea, sometimes dyspnoea, tachycardia, and dysentery. When the oedema passed off the limbs were wasted and painful. Albuminuria was recorded in one case. In the fatal cases there was marked cardiac dilatation and death was due to heart failure. In this outbreak the very limited distribution, sudden onset, absence of outside evidence of infection, pointed to food being the cause of the disease. In the other two epidemics the infection is also stated to have been traced to the use of food from particular shops but no definite proof is given. The author makes some remarks on the appearance and disappearance of the epidemics and gives details of cases which are of little interest, and he throws no new light on the etiology. [This is a distinct disease from beriberi with which the author appears to confuse it.]

P. W. B-S.

McCollum (E. V.) & Kennedy (Cornelia). **The Dietary Factors Operating in the Production of Polyneuritis.**—*Jl. Biol. Chem.* 1916. Apr. Vol. 24. No. 4. pp. 491–502.

In reviewing previous work on the essential substances that are required for growth, described by Funk and others as "Vitamines" and Hopkins as "Accessory," the authors point out that neither terms are correct, Vitamine claiming too much, Accessory too little. The authors have formulated an hypothesis that in addition to the ordinary constituents of diet—proteins, carbo-hydrates, fats, and inorganic salts—the growing animal requires two substances, or groups of substances: one which is soluble in fat, A, and a second soluble in water and alcohol, B. In this paper they report further work on these two classes of substances. The experiments were carried out on pigeons; polished rice and butter fat, polished rice and alcoholic extracts of fat-free wheat embryo, potato juice, cabbage juice, oat extracts, and acetone, benzene, and ethyl extracts of fat-free wheat embryo were used. From their investigations they conclude that it seems certain that both the fat-soluble substance A and the water-soluble substance B are essential for life as well as growth, and that in the production of polyneuritis in birds by the exclusive feeding on rice or purified food stuffs the degeneration of the nerve cells is the specific result of a deficiency of the water soluble B. "The fat-soluble A appears to be dispensable, when maintenance alone is involved, for a somewhat longer period than is the factor B." The details of the experiments are given and those interested in the subject should read the paper in the original.

P. W. B-S.

Eijkman (C.). **Invloed van de voeding en van voedselonthouding op het onstaan van polyneuritis gallinarum, Naar gemeenschappelijk met Dr. C. J. C. van Hoogenhuyze ingestelde onderzoekingen medegedeeld.** [The Influence of Feeding and Deprivation of Food in the Production of Polyneuritis Gallinarum. A Research undertaken with the Co-operation of Dr. C. J. C. van Hoogenhuyze.] —*Geneesk. Tijdschr. v. Nederl.-Indië.* 1916. Vol. 56. No. 3. pp. 257–294.

A research undertaken by the author on the subject of fowl polyneuritis. The birds under investigation were kept without food but were given large quantities of water, either by the mouth or subcutaneously, normal salt solution and Ringer's fluid being also employed. The result was the induction of typical polyneuritis after an interval, varying between 14 and 28 days according to the condition of the bird, by which time the original weight of the bird had been reduced by about 40 per cent. Control experiments were carried out in which the birds were supplied with water, but were kept without food, with the exception that 5 grammes per day of compressed yeast were given. Under these conditions polyneuritis did not supervene, though the test was continued till the birds had lost more than 50 per cent. of their weight. The experiment was varied by giving various kinds of food, such as polished rice, but the details need hardly be given.

The author's conclusions are summarised as follows :—

1. The observations of Chamberlain, Bloombergh and Kilbourne, to the effect that entire deprivation of food, by itself, can produce fowl polyneuritis* is confirmed, and the supervention of such symptoms is aided by copious washing out with water. The polyneuritis is therefore to be regarded as being solely the result of a deficiency in protective, or anti-neuritic substances, the so-called vitamines. If these are supplied in the form of yeast, then the disease does not occur in spite of an extreme degree of emaciation. Yeast will, of course, prevent the polyneuritis induced by a defective diet in the same way. Birds submitted to these experiments exhibit a resistance to the supervention of symptoms in proportion to the goodness of their original condition.

2. On these grounds the idea of a tissue poison in the food, or one arising from mal-digestion in the alimentary canal, can be excluded, as the cause of polyneuritis. On the other hand, the idea of a tissue-poison produced by the alteration of tissue changes incidental to starvation or mal-nutrition is favoured.

3. Even when polyneuritis is induced, no direct relation can be traced between the degree of inanition and the tissue degeneration induced, in the sense that the latter is the result of the former. Most commonly the polyneuritis supervenes before the loss of weight is very marked.

4. Feeding does not play the chief rôle in the production of the disease, but affects its course.

5. A supply of food probably brings about an improved utilization of the protective substances in the organism ; but the view of Braddon, Cooper and Funk that carbohydrates are more important in this connection than proteids does not seem well founded.

6. The digestion of raw polished rice by fowls is assisted by the addition of cellulose, in the form of washed rice-bran, sawdust and paper-fibre, but not by the addition of anti-neuritic rice-bran extract. The addition of cellulose thus improves the state of nutrition, but the supervention of polyneuritis is thereby more hastened than delayed. Finally, all conclusions as to the influence of different factors on the production of polyneuritis in birds are much affected by variations in the condition of individual birds, so far as concerns the date of the supervention of symptoms.

J. B. N.

Breinl (A.). **Note on Experiments on Polyneuritis in Pigeons.**— *Jl. Trop. Med. & Hyg.* 1916. June 1. Vol. 19. No. 11. pp. 129–130.

This is a contribution bearing on the infectiousness or otherwise of beriberi. Mc Garrison (1914) has described some experiments on pigeons, from which he obtained cultures of an organism which when inoculated into rabbits produced symptoms of polyneuritis [see this

* *Philippine Journal of Science.* 1911. Vol. 6. p. 177

Bulletin, Vol. 5, p. 116]. Before the appearance of this paper some experiments had been carried out at Townsville to see if the polyneuritis of pigeons was infectious and whether their cages became infected, and afterwards to see if any organism could be found in the blood and organs of the diseased birds similar to that described by Mc Garrison.

These were not confirmatory, no infective organisms were obtained from the blood of 12 paralytic pigeons, and there was nothing to show that the cages in which the infected birds were kept had any influence in producing the disease in normal pigeons fed on ordinary diet. A short record of the experiments is given in a tabular form.

P. W. B-S.

Book Reviews.

Maxwell-Lefroy (H.) [M.A., F.Z.S.]. **Measures for Avoidance and Extermination of Flies, Mosquitoes, Lice and Other Vermin.**—17 pp. With 5 figs. 2nd Edit. Revised for the Tropics. 1916. London: W. Thacker & Co., Calcutta & Simla: Thacker, Spink & Co. [Price 1*s.* net.]

This pamphlet, a second edition with added matter "specially applicable to India," is accurately described by its title. The methods described have been proved useful, and the formulae and direction for preparing the various insecticides are given in an appendix. Eleven pages are given to lice and flies and some fly traps are illustrated; the section on mosquitoes contains nothing that is not known to medical men in the tropics. The pamphlet is entirely practical and it is worth the while of all tropical practitioners to obtain it.

A. G. B.

Moullin (C. Mansell) [M.A., M.D. Oxon, F.R.C.S.]. **The Biology of Tumours.**—55 pp. Demy 8vo. 1916. London: H. K. Lewis & Co., Ltd. [Price 2*s.* 6*d.* net.]

This little book is a development of the Bradshaw Lecture given before the Royal College of Surgeons in 1912. The author expects to meet with adverse criticism. He considers the most satisfactory basis for classification of tumours to be their mode of origin, and divides them into those due to the reproductive power of the tissues being suddenly roused into activity and those due to changes that occur in the course of development being imperfectly carried out. The first are gemmation tumours; the primitive power of asexual reproduction is revived. They include the vast majority. He divides them into those springing from the germ cells and somatic cells respectively. He proceeds to discuss the conditions that lead to the production of tumour buds, the arrest of tissue development and the inheritance of gemmation tumours, the conclusion being that tumours cannot be transmitted by inheritance but the condition that is essential for their production can be. The account is one which cannot fail to interest.

A. G. B.

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MOULLIN (C. Mansell), M.A., M.D. Oxon., F.R.C.S. The Biology of Tumours.—55 pp. Demy 8vo. 1916. London: H. K. Lewis & Co., Ltd. [Price 2*s.* 6*d.* net.]

The Bureau is indebted to Miss STOEHR for the return of some early numbers of the *Sleeping Sickness Bulletin* and an Index. Parts of Vols. 1 and 4 of the *Sleeping Sickness Bulletin* and the Indices to Vols. 2, 3 and 4 are out of print, and anyone who has copies which he does not need is asked to be so good as to notify the fact to the Bureau.

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